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A TEXT-BOOK

OF THE

PRINCIPLES AND PRACTICE

OF

MEDICINE,

FOR THE

USE OF MEDICAL STUDENTS AND PRACTITIONERS.

BY

HENRY M. LYMAN, A.M., M.D.,

PROFESSOR OF THE PRINCIPLES AND PRACTICE OF MEDICINE IN RUSH MEDICAL COLLEGE, CHICAGO.

WITH ONE HUNDRED AND SEVENTY ILLUSTRATIONS.







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TO

STEPHEN SMITH, M.D.,

PHYSICIAN, SURGEON, AUTHOR, AND TEACHER,

THIS VOLUME

IS

DEDICATED

BY A

GRATEFUL PUPIL.

PREFACE.

In this volume I have endeavored to present, in addition to the fruits of my own observation and experience, the substance of the latest editions of the works of Ziegler, Hallopeau, Eichhorst, Cornil, and Babes, and of the collaborators of the Traité de Médecine.

In order to secure the greatest possible brevity, matters of an historical and controversial nature have been omitted, and every effort has been made to exclude whatever is not absolutely essential for the information of the student. Numerous interesting topics have accordingly received but brief notice. It has seemed best to aim at the construction of a definite framework which the future physician can clothe with the results of subsequent reading and observation.

In the arrangement of topics I have ventured upon a departure from the time-honored order of sequence. Having acquired a knowledge of the diseases that involve the external surface of the body, of which so many are of a parasitic nature, it seems best to begin the study of internal medicine by continuing the investigation of parasitic diseases. This leads to a consideration of the infective diseases and the disorders of the alimentary canal and respiratory organs, through which so many contagia find entrance into the body. Diseases of the blood and of the organs of circulation lead naturally to the inflammations and degenerations; and disorders of nutrition and of the nervous tissues complete the field of observation.

If the sections that are devoted to medicines and their administration seem brief, they have been so arranged with the purpose of presenting the best methods of treatment and of preventing the confusion which would be caused by listing a multitude of remedies, among which it is difficult to decide in favor of the best. The medicinal agents and the doses that are set forth are usually those which are the most generally applicable in hospital practice and in treating the majority of patients.

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PART I.

RELIMINARY CONSIDERATIONS.

CHAPTER I.

ORGANIZATION OF THE BODY.

y living creature that inhabits the earth is provided with an d body, of which the simplest form is a mere speck of appa- ndifferentiated protoplasm constituting a spore or cell; but ıigher orders of existence the body consists of members and of hat have been formed by the orderly arrangement and connec- impler organisms, called elementary parts or cells. These con- fly of protoplasm that has been formed by the union of inorganic es that have been united by chemical attraction, and are retained e of moving equilibrium by the molecular and physical forces rate upon all forms of matter. In this respect a vegetable or al organism possesses much that is common with the mineral ents of the globe; but it requires very little observation to dis- rtain notable differences between the formation and growth of l, which may be considered as the type of mineral structures, growth and development of a plant or of a frog. The crystal by accretion. Chemical, molecular, and physical forces seem to ient for its formation, but for the development and growth of a of an animal, something more is required. Such structures con- umerous parts, which, in their turn, are composed of individual d these cells possess the power of division and multiplication. crease, not by accretion, but by assimilation of matter which ıe inmost substance of the mass, and there becomes incorporated hrough the agency of chemical attraction. This process, how- es not go on indefinitely, but is conducted in such a way as to the evolution, for each species of plant or animal, of a different e, possessing certain average characteristics of form, size, and . Apparently something more than ordinary chemical attrac- oncerned in this process.

e present state of our knowledge it is, therefore, convenient to the existence of special organizing or *vital forces*, that coördi- living bodies the chemical, physical, and molecular attractions rate between all forms of matter. This assumption may be

employed as a convenient working hypothesis; but the student must not consider this an explanation that throws any light upon the nature of such coördinating forces. It is probable that, like all other material forces, they are to be looked upon as local and temporal manifestations of the Infinite and Imminent Power by which the Universe is evolved.

Organic structures that have been thus formed are said to be *alive* so long as the organic forces that are active among the atoms and molecules are coördinated and dominated by the vital force that sustains their organization; but if this force be overcome by the operation of antagonistic forces, it ceases to act, and life is merged in death. The ordinary course of chemical exchange is resumed among the molecules of the now dead body; disintegration (the reverse of organization) rapidly resolves the structure into its original inorganic components, and the organism ceases to exist. But sometimes it happens that the antagonistic forces of Nature do not operate with violence sufficient to inhibit the vital forces in a given body. The ordinary forces of Nature, light, heat, electricity, gravitation, etc., often encounter the living body with violence sufficient to cause its death; but under other conditions their intensity may be so far modified that instead of antagonizing vital force, they stand in favorable concurrence with its coördinative activity, and thus aid in the evolution of the phenomena of life. The heat of the sun that in midsummer burns up the crops, is in spring and in autumn most favorable to their growth. The electrical current that paralyzes a nerve or a muscle, may be so moderated that, instead of arresting, it shall greatly invigorate the functions of such organs.

It appears, therefore, that every living body, whether plant or animal, is formed under the influence of vital forces that appropriate and organize non-living matter in the presence of other forces that may favor or may oppose this process. Between these poles of favor and opposition lie many zones of more or less perfect organization. Observation shows that not every living body presents an established type of uniform structure and function. There may be imperfect development of certain organs, as in hermaphrodites; there may be unsymmetrical growth, as when one limb is smaller than the other; or the body, though well formed, may differ in size and strength from the usual dimensions of its kind; again, a body that was perfectly organized may be invaded by parasites that seek to appropriate for their own use matter that is needed to maintain the structure of their host; or certain poisons may be introduced within a living body, more or less completely inhibiting its energy.

In these and in other ways can be produced a variety of deviation from the standard type of structure and function that would be otherwise obtained through the unimpeded activity of the organizing forces that are concerned with the evolution of life. Such deviations, if slight, may be disregarded; but when considerable in amount they constitute a state that, if progressive, is known as *disease*.

Such variations from the normal type may progress for a time, and may be then arrested, leaving as their permanent result a stable change of structure and function that is called the consequence of disease—

e.g., ulceration, followed by cicatrization. In certain cases, upon the return of favorable conditions, the forces of organization may resume their sway throughout the body; morbid processes cease; their consequences are removed, and health is restored—*e.g.*, pneumonic infiltration of the lung, and subsequent removal of the exudation.

From these and from similar considerations it appears that HEALTH may be defined as *the condition of structure and function that most perfectly fulfils the purpose for which an organism exists.* In like manner it may be concluded that *every extraordinary departure from the normal structure and function of the living organism constitutes* DISEASE.

It is inconceivable that any considerable disturbance of organic function can exist without an underlying perversion of structure. When such structural changes become evident to the senses, the accompanying disease is said to be *organic* in its character. But when the structural change is of such an infinitesimal character that it escapes detection, the abnormal function is called a *functional disease.*

The indications by which the existence of disease is recognized are termed *symptoms.* These are *subjective* when of such a character that they can be demonstrated only by reference to the sensations and statements of the patient himself; they are said to be *objective* when they admit of observation on the part of others. Indications that may be noted by the eye, or ear, or the sense of touch, are known as *physical signs*—a term that is usually applied to symptoms that are afforded by *inspection*, *auscultation*, *percussion*, and *palpation* of the thorax and abdomen.

Diagnosis is the act of decision with regard to the location and nature of a given disease. *Differential diagnosis* consists in the differentiation of a disease from others by which it is closely resembled. This process is sometimes called *diagnosis by exclusion*, when the diagnosis is reached by a rational exclusion of all other diseases that might possibly be present in the case under consideration.

Pathology is the comprehensive statement and explanation of morbid processes. That department of pathology which deals with the structural changes that are produced by disease, is termed *pathological anatomy.*

Etiology treats of the causes of disease. These are usually divided into *predisposing causes* and *exciting causes.*

Prognosis is the statement of the results of experience regarding the course and termination of disease.

Treatment is concerned with the remedial management of disease.

CHAPTER II.

GROWTH AND DEVELOPMENT.

AN investigation of the reproductive process exhibits the transformation of unicellular germs into complex structures that are built up out of elementary parts, of which many resemble the parent cell, while others are widely differentiated from the original germ. Witness the difference between the cells of a striated muscular fibre and the embryonic cells of the ovum out of which they have been perfected. This process of orderly deviation from the original form is called *development*. It is the process by which the different tissues and organs of the fœtus embryo are produced.

Growth, on the other hand, is the result of an increase in the number of similar elements in an organ or tissue. Development, therefore precedes growth. Mere increase in size must not be confounded with growth, however, since enlargement may be caused by simple expansion of constituent cells without multiplication of their number—*e.g.* in the salivary glands the secreting cells vary in size according to the state of their activity, and the whole gland may be distended and enlarged by the products of secretion, though the number of its cells may not be notably increased. In like manner the bulk of the subcutaneous areolar tissue may be greatly enlarged by an accumulation of fat within its cells, even though their actual *number* be considerably diminished during the process.

CHAPTER III.

REGRESSIVE DISTURBANCES OF NUTRITION.

THE process of development and of growth cannot go on indefinitely. Sooner or later every organism reaches its appointed limit in time and space. The life of the body may be suddenly terminated by the arrest of its functions. This is *death*. Dissolution, the opposite of evolution, now commences. The tissues which have been developed, and which have grown under the protective and coördinating influence of vitalizing forces, now undergo a retrograde process, and are speedily resolved into their elementary molecules.

The processes of regressive metamorphosis are not limited, however, to the dead body. During the life of every organism individual portions of its structure are suffering disintegration, through which they cease to live, and are cast out again into the world of non-living matter

This process of local death and disintegration is termed *necrosis*. It may involve a considerable portion of the body; it may be restricted to a single cell; or it may involve only the minutest portions of a cellular structure.

The causes of necrosis may be *mechanical*, as when a portion of the skin is destroyed by pressure or by violence; *chemical* when similar destruction is wrought by the action of a chemical agent, like sulphuric acid. Excessive *cold* and *heat* are also fatal to the tissues that are exposed to their influence. Even the comparatively slight elevation of temperature that occurs in certain fevers is sufficient to produce the death of protoplasm in many of the living cells of the body. The life of the tissues may be also destroyed through *failure of the supply of nutriment* that should be furnished by the blood. In this way death quickly follows when the blood is deprived of oxygen.

In highly developed organisms like the human body, the life of certain tissues—*e. g.*, the muscles—is dependent upon their *connection with the central nervous organs* of the body; and when that connection is interrupted either by disease or by injury, the death of such tissues speedily follows. When such interruption of innervation is concurrent with pressure upon the enfeebled tissues, gangrene rapidly follows—*e. g.*, the bedsores which occurs during severe forms of fever—diseases of the spinal cord, etc.

Coagulative necrosis is a condition in which sudden arrest of the circulation causes precipitation of fibrin in the form of minute granules, either in the blood and lymph, or in the protoplasm of the cells, or in the products of exudation, causing a swelling and induration of the tissues that are involved.

Caseation is a form of necrosis in which the constituents of the tissue become transformed into a cheese-like mass. This process is frequently observed in the lungs during the progress of tubercular disease. The affected tissues having been caseated, the necrotic mass is sometimes infected with pyogenic bacteria which produce suppuration, softening, and disintegration, with subsequent discharge of the broken-down substance, producing a cavity in the lung or other affected organ.

Gangrene is the putrefaction of a portion of the body. When the gangrenous tissues are exposed to dry air they frequently undergo dessiccation, constituting what is known as dry gangrene or mummification. This process is usually observed in the extremities, involving the toes or the fingers, as a consequence of senile changes in the arteries, by which the supply of blood is arrested. When the necrotic tissues are abundantly infiltrated with liquids they become extensively invaded by the microörganisms of putrefaction, and through their action the dead or dying tissues are rapidly decomposed with the evolution of offensive gases, constituting what is described as *moist gangrene* or *sphacelus*.

It sometimes happens that particular organs or portions of the body fail to grow according to the normal laws of growth, so that they remain permanently smaller than their fellows. This condition of imperfect and deficient enlargement is termed *hypoplasia*. The condition is usually congenital, though it is sometimes manifested as a consequence

of insufficient nutrition, or of causes that escape explanation—*e.g.*, chlorotic patients frequently exhibit a deficiency in the size and growth of the vascular organs of the body; or perhaps their sexual organs never attain to full development.

Atrophy is the shrinkage or destruction of a tissue or organ which had previously attained its normal growth. A certain amount of atrophy is common to the entire organism in the later years of advanced life, constituting *senile atrophy*. A similar but earlier atrophy is witnessed in childhood in the case of the thymus gland, and in the middle life of women on the part of their reproductive organs at the menopause. When muscles, bones, glands, and other tissues are placed in a condition of inactivity they undergo *atrophy from disuse*. When similar organs are disconnected from the spinal cord by injury of the peripheral nerves, they undergo a *neurotic atrophy*, which is the consequence of the suppression of nervous impulses by which their nutritive processes are normally controlled. The arrest or the diminution of the supply of blood that should be furnished to a given organ or portion of the body, is followed by *atrophy through partial starvation;* though this process frequently terminates in actual degeneration. The best examples of atrophy are furnished by the shrinkage and displacement of tissue that occur in chronic inflammation of the liver and the kidney, in amyloid infiltration of those organs, and in cirrhosis of the liver, by which the secreting cells of the gland are compressed through contraction of the inflamed connective tissue. Atrophy in these cases results from direct and continuous pressure, and is termed *pressure atrophy*. When a tissue is subjected to intermittent compression, it becomes hypertrophied, instead of undergoing atrophy.

As a consequence of regressive changes in the nutrition of a tissue, the constituent cells of the affected part exhibit various forms of degeneration. Of these the simplest variety is termed *cloudy swelling*. (Fig. 1.) This consists in an accumulation of minute granules of albumin within the substance of a cell, causing it to swell, assume a cloudy appearance, and lose the clear definition of its outline. This process is most conspicuous in the parenchymatous cells of the large glandular and muscular organs. It is produced by excessive bodily temperature, by inflammation, by infective processes, and by certain poisons. The affected cells appear to lose their nuclei, which, however, are merely veiled by the multitude of granules in the protoplasm. Sometimes the degenerating cells imbibe large quantities of water, constituting what is termed *hydropsical degeneration*.

FIG. 1.



Cloudy swelling of liver cells. × 300. (ZIEGLER.)

Fatty degeneration consists in the destruction of the cell and its appendages by the conversion of its protoplasm into fatty matter. (Fig. 2.) This differs from fatty infiltration in the fact that it is a necrotic process, while infiltration with fat is a mode of physiological development. Cells that have experienced fatty degeneration are called *compound granular corpuscles*. In appearance these resemble cells that

have undergone cloudy swelling, but they are larger, and the granules in their protoplasm are minute particles of fat instead of albumin. Cloudy swelling frequently precedes fatty degeneration. The degenerative process is connected with changes in the blood and in the cells by

FIG. 2.

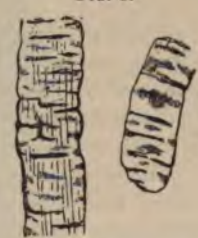


Fatty degeneration of heart. *a*. Rupture of the heart with diseased arteries. *b*. Purpura. *c*. Pericarditis. *d*. Ordinary form. *e*. Uterine muscular fibres a week or two after delivery. *f*. Granule cells. *g*. Cancer cells. (BRISTOWE.)

which the transportation of oxygen and its assimilation are hindered. Fatty degeneration is, therefore, a common consequence of anæmia, and of poisoning with phosphorus, chloroform, iodoform, arsenic, the mineral acids, etc.

Colloid degeneration consists in the transformation of protoplasm into a homogeneous jelly-like substance, resembling glue. (Fig. 3.) This form of degeneration is found in cancerous tumors, in cystic ovarian tumors, and it characterizes the hyaline casts that are thrown off from the tubules of the kidneys in certain diseases.

FIG. 3.



Colloid degeneration of muscle. × 250. (BRISTOWE.)

Mucoid degeneration is a process by which the affected tissues are transformed into a jelly-like substance containing mucin. It usually occurs in tumors that involve the connective tissue, such as fibrous, sarcomatous, cartilaginous, or fatty tumors.

Amyloid degeneration, sometimes termed waxy, lardaceous, or albuminoid infiltration (Fig. 4), is caused by the infiltration of an organ or tissue with a nearly solid substance that is identical in composition with albumin, and is stained mahogany-brown by a solution of iodine. Structures that have been thus infiltrated are rigid, elastic, somewhat enlarged, and waxy in appearance. The form of degeneration is most frequently encountered in the liver, kidneys, spleen, stomach, intestines, heart, arterial walls, lymphatic glands, and sometimes in the tissues of the lungs, skin, and supra-renal capsules. Similar masses of infiltrated matter are found in the central nervous organs in various diseases of the nervous system, constituting what are

called *amyloid* or *colloid bodies*. Nothing positive is known regarding the nature and cause of amyloid degeneration. It generally accompanies tubercular and syphilitic processes, prolonged suppuration, chronic diarrhœa, wasting diseases, and leukæmia.

FIG. 4.



Lardaceous degeneration of kidney. *a*. Section of tubes of medulla. *b*. Malpighian body and afferent vessel. × 250. (BRISTOWE.)

Hyaline degeneration chiefly involves the connective tissue, and closely resembles in its general appearance the result of amyloid degeneration; but the products of hyaline degeneration differ from amyloid matter, since they are not colored by iodine, and do not display the histological features of mucoid degeneration.

Calcification is a process by which degenerated tissues become infiltrated with insoluble salts of calcium and magnesium. This process frequently occurs in the coats of the arteries (Fig. 5), in various tumors and in cartilaginous tissues, as a consequence of old age. The process is often witnessed in tubercular masses that have undergone caseation. Similar concretions are sometimes formed in the ducts of the pancreas, salivary glands, prostate glands, crypts of the tonsils, intestines, urinary passages, etc. An allied form of calcification is often witnessed about the joints in old cases of gout. (Fig. 6.)

Pigmentary degeneration. In many parts of the body the connective tissue and the epithelial structures contain pigment as a normal constituent; but as a consequence of various morbid processes the amount of pigment may be greatly increased, or it may be deposited where it should not exist. Pigments are either derived from the coloring matter

of the blood, or they may be introduced into the organism from the external world.

Pigmentation with hæmoglobin frequently occurs after death, when the red blood-corpuscles have become disintegrated. The blood serum then contains hæmoglobin in solution, and the lining membranes of the heart and larger arteries become stained by infiltration with this form of coloring matter.

FIG. 5.



Calcareous degeneration of cerebral vessels. × 250. (BRISTOWE.)

FIG. 6.



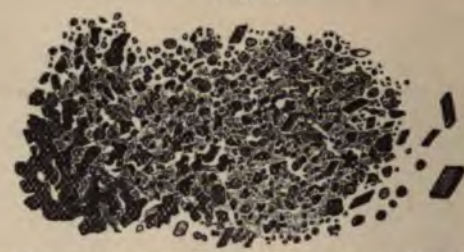
Cartilage of joint infiltrated with urate of soda. × 250. (BRISTOWE.)

The hæmoglobin of old clots, such as are found in the brain or in aneurismal cavities, is frequently transformed into *hæmatoïdin*, which, by its accumulation, occasions pigmentation of the adjacent tissues. (Fig. 7.)

Melanine pigmentation, or *melanosis*, is another form of pigmentation that occurs in the degeneration of connective tissue, and in new growths, especially when they involve parts that are already pigmented.

This is very conspicuous in Addison's disease, where those portions of the skin that are normally colored become very deeply darkened by the melanotic deposit. In intermittent fever the blood, the spleen, the liver, and the adjacent organs, become highly charged with melanine.

FIG. 7.



Pigmental degeneration with hæmatoid crystals. × 250. (BRISTOWE.)

Lutein pigmentation. Lutein is a substance closely related with hæmatoidin. It exists in the yolk of the egg and in the corpus luteum of the ovary.

Bile pigmentation. The coloring matter of the bile frequently stains the tissues when obstruction of the common bile-duct causes its absorption into the circulating fluids of the body. It also stains the peritoneal surfaces in the vicinity of a distended gall-bladder. The mucous membrane of the stomach and of the intestines may be also pigmented by excessive discharge of bile into those organs.

Purulent pigmentation. Pus sometimes assumes a blue, red, orange, green, or yellow color through the presence of microbes that secrete colored pigments.

Pigmentation with substances derived from the external world is often witnessed as a consequence of inhalation of minute particles of carbon, which are deposited in the walls of the air vesicles of the lungs. The long-continued administration of nitrate of silver may lead to a slate-colored pigmentation of the skin. Arsenic also sometimes causes a brown stain in the substance of the integument.

Cystic degeneration consists in the formation within a tissue or organ of a cavity surrounded by a connective-tissue capsule or other form of limiting membrane. Such cysts may be either *simple* or *multilocular*. They are most frequently produced by the occlusion of a normal glandular canal, constituting what is termed a *retention cyst*. The follicles of the thyroid gland or of the ovary sometimes undergo cystic degeneration as a consequence of excessive secretion within their cavities. The contents of a cyst are determined by the character of its wall, *e. g.*, glandular cysts contain the more or less modified secretions of the gland. Sometimes cysts are produced by the process of softening and liquefaction of a circumscribed portion of an organ. Such cysts are found occasionally in the brain. Foreign bodies and parasites that have found their way into the tissues are frequently encapsulated by a cystic growth of connective tissue around the intruding body.

CHAPTER IV.

PROGRESSIVE DISTURBANCES OF NUTRITION.

HYPERTROPHY. When an organ or tissue has actually exceeded the normal standard of growth, through increase in the size of its constituent cells, it is said to be hypertrophied. Witness the increase that occurs in the muscles of a laborer. Hypertrophy may thus result as the consequence of excessive normal function, but it may be also a consequence of disease, as can be observed in the increase of muscular tissue in the heart when its valves are deficient. If, however, the enlargement be due to an increase in the number of the constituent cells of an organ or tissue, the process is termed *hyperplasia*. Again, hypertrophy must not be confounded with mere enlargement. The size of a fatty liver or kidney may be greatly increased by the presence of fat within its cells, but unless the number of liver cells be actually raised beyond the normal standard, there is no hypertrophy. The organ is rendered bulky by fatty infiltration of its cells, which, very likely, have been actually diminished in number during the process. Local hypertrophies that do not involve an entire organ or tissue are called *neoplasms*.

The process of *hyperplasia* is dependent upon the multiplication of the cellular elements of the parts in which a progressive disturbance of nutrition has been initiated. The process of multiplication, termed cellular proliferation, consists in the formation of new cells by subdivision of the original elementary parts of the tissue. The nuclei of the cells divide into two or more masses, which become the central nuclei of the new generation. Division of the nucleus is usually followed by a corresponding division of the perinuclear protoplasm, so that the parent cell splits up into two or more completely developed cells, which in turn undergo similar subdivision. In this way the process of multiplication proceeds with great rapidity. Sometimes, however, though the nuclei undergo extensive subdivision, the surrounding protoplasm does not exhibit a similar change. Such polynucleated cells become greatly enlarged, and are called *giant cells*. (Fig. 8.) They are frequently observed in the course of tuberculosis and in other pathological processes.

The causes of cell proliferation and hyperplasia are connected with the quantity and quality of the nutriment that is furnished by the blood for the nutrition of the tissues. An increased supply of wholesome nutriment favors growth, but does not necessarily produce hyperplasia. In like manner the normal function of a tissue or organ is favorable to its growth, but when an abundant supply of nutriment is associated with extraordinary excitement and excessive functional activity, the limit of simple hypertrophy may be easily transgressed and hyperplasia begins. The presence of certain substances in the

blood occasions abnormal excitement, and thus produces subdivision and multiplication of the constituent cells that are exposed to irritation; but if such irritation be carried too far, the hyperplastic process ceases, and inflammatory or regressive changes of a degenerative character are manifested. Thus, when one kidney is removed and the other kidney is therefore compelled to excrete urine for the entire body, it becomes greatly enlarged (hyperplasia); but if at the same time the blood that circulates in the organ should contain an excess of irritating alcohol, or toxines derived from bacterial sources, the hyperplastic tissues undergo a process of regressive degeneration that leads to necrosis of their elementary parts.

FIG. 8.



Tubercle showing—*g*, giant cells with prolongations, and *e*, epithelioid cells. (PAYNE.)

Hyperplasia is sometimes due to the absence of the normal resistance by which, under ordinary circumstances, excessive cell proliferation is prevented, *e. g.*, in a granulating ulcer the rapid growth of granulations is largely due to the fact that the bloodvessels are exposed and released from the protecting pressure of the skin. So soon as the ulcerous surface is covered by a cicatricial tissue the hyperplastic process ceases.

Mention has been made of the fact that impregnation of the blood with certain poisonous substances, such as alcohol or bacterial toxines, may produce degenerative changes in the tissues. It is also true that these and other similar poisons may cause hyperplasia if they be not present in quantity sufficient to destroy cell life. Thus the moderate, but persistent use of alcoholic beverages leads to hyperplasia of the connective tissue in the walls of the stomach and in the liver. In like manner the secretions of streptococcus and staphylococcus pyogenes excite a modified process called inflammation, in which hyperplasia and necrotic degeneration are associated.

When hyperplasia occurs in a compound organ, its component tissues are often very differently affected by the process. Thus in the

liver, the connective tissue frequently undergoes extensive hyperplasia, while the parenchyma of the gland either undergoes no increase or is actually subjected to atrophy as a consequence of compression by the hyperplastic connective tissue. Such unequal manifestations of the tendency to cell proliferation are common consequences of chronic inflammation, and are a very fruitful source of dangerous disease and destruction of the organs that are thus invaded.

The regenerative processes by which wounds or other defects are repaired, sometimes exert a similar evil effect upon the structures in which the process of repair has been effected. The formation of *cicatricial tissue* is sometimes a source of great embarrassment to the function of an organ. Since the newly-formed tissue does not replace that which has been destroyed, its contraction may occasion great deformity and constriction of the remaining tissues, *e. g.*, the formation of cicatricial tissue after cerebral hemorrhage, or in the curtain of a cardiac valve, may permanently disable the brain or the heart. The formation of such cicatricial tissues, which though normal in character do not replace the elements that have been destroyed, is termed *heteroplasia*. Other conspicuous examples of heteroplastic growth are furnished by the formation and growth of tumors.

Under certain circumstances a transformation of one tissue into another may be witnessed. This process is termed *metaplasia*. The connective tissues exhibit the most conspicuous examples of such transformation. Thus the mucous tissue, or the subcutaneous areolar tissue, or a lymph-adenoid tissue may be transformed into fatty tissue. Cartilage may also be transformed into mucous tissue, or it may become infiltrated with earthy salts and converted into bone. In chronic inflammation of the mucous membranes, cylindrical epithelium is often in like manner replaced by or changed into pavement epithelium.

CHAPTER V.

TUMORS.

In the present state of science it is impossible to furnish an adequate and comprehensive definition of the word *tumor*, since the causes and growth of such masses are not yet understood. From a clinical point of view, however, a tumor may be defined as *a mass of tissue developed where it does not belong, and manifesting a tendency to increase and to become permanent.*

Tumors are formed by the multiplication of normal tissue cells, consequently there may be as many varieties of tumors as of the tissues themselves; osseous tumors are developed from the elements of bone; fibrous tumors from fibrous tissues; enchondromatous growths from cartilage; and myomas from muscular fibres. The structure of such tumors is said to be *typical*. When tumors are developed out of

undifferentiated embryonic cells, they are termed *proto-typical* growths, to indicate their origin from embryonic elements. When tumors are formed partly from embryonic cells and partly from tissues that have been already differentiated, the new growth is said to be of a *mixed* character. Besides these forms must be recognized tumors that contain rudimentary fœtal structures; these have their origin apparently in a misplacement of reproductive elements.

It has been recently ascertained that certain forms of epithelioma (warty growths) are due to the action of protozoa which develop in the tissues. It is highly probable that other species of tumor may be produced through the activity of other parasites; but in the present state of our knowledge this opinion is purely hypothetical.

An ingenious hypothesis was formulated by Cohnheim, who endeavored to show that every tumor had its origin in a disorder of the evolution of the embryo. As a consequence of vicious organization, a group of embryonic elements might be retarded in their development until a certain period in the life of the individual had been reached; or until by reason of some accidental injury they were excited to multiplication; or by such injury were released from the restraining influence of the adjacent normal tissues. In many instances, undoubtedly, the exciting cause by which was aroused the proliferating energy of a latent mass of embryonic tissue must necessarily elude discovery, being dependent upon processes that are not yet understood. This hypothesis affords an exceedingly plausible explanation for the growth of tumors that are composed of elements which differ from the tissues in which they originate. When a cartilaginous tumor develops in a bone, it seems highly probable that the embryonic elements of cartilage were originally included in the osseous tissue. But, despite the multitude of facts by which the argument is supported, it must be admitted that it leaves many things still unexplained. It will be necessary to wait for additional information before a complete theory of the genesis of tumors can be constructed.

The rapid growth of a tumor is due to the multiplication of its cellular elements, which divide and subdivide with great rapidity. The mass is permeated by numerous bloodvessels and lymphatic canals, which in many neoplasms furnish an abundant circulation throughout the entire growth. Tumors, like malignant cancers, that consist chiefly of embryonic tissue, are provided with bloodvessels with very thin walls that are easily ruptured, and give origin to more or less copious hemorrhage. When a tumor is chiefly formed out of differentiated tissue, like a fibroma or a fatty tumor, the vascular walls are dense and are not easily ruptured.

The elements of which a tumor is composed frequently undergo degenerative processes, such as fatty, colloid, mucous, pigmentary, or calcareous degeneration. *Colloid degeneration* is frequently observed in epithelial and cartilaginous tumors and in sarcoma. *Calcareous infiltration* is sometimes discovered in cartilaginous and fibrous tumors and in the endothelial tumors of the dura mater, constituting what is termed *psammoma*.

The growth of a tumor is usually continuous, but in certain cases

he volume of the mass may for a time diminish, though it never disappears.

r neoplasms present a clearly defined boundary, but it is often to determine the limits of a tumor, especially when dealing ithelial growths whose elements multiply rapidly. The adjacent become extensively invaded by prolongations of newly formed hich follow the lymphatic vessels, and push aside the normal es of the part. In this way the lymphatic glands in the rhood of the new growth are frequently invaded by the morbid

Minute particles of the tumor are sometimes transported to ce through the medium of the circulation, and become centres tion remote from the original growth. In this way are fre- originated *secondary tumors*, which may develop and enlarge :er the removal of the primitive tumor from which they were

When a serous membrane is thus invaded, it sometimes be- ›overed with minute nodules that in appearance considerably e miliary tubercles (miliary carcinoma).

. a clinical point of view tumors may be considered as benign or as malignant growths. A *benign tumor* enlarges slowly, t ulcerate nor disseminate its elements throughout the organism, extirpated, is not reproduced. *Malignant tumors* exhibit ex- ›pposite characteristics. The malignancy of a tumor is con- › in proportion to the embryonic character of its elements, and ascularity of its structure.

›eculiar *cachexia* and *anæmia* that accompany the growth of nt tumors are ascribed to a general poisoning of the system e products of morbid cell growth; but, perhaps, they may be the diffusion of the secretions of yet undiscovered parasitic which possibly are concerned in the formation of such neo-

:lassification of tumors varies with the progress of knowledge. the mystery that veils the origin and development of neoplastic shall be dissipated, it is probable that an entirely new method ification will be found necessary. At present the histological though not without its disadvantages, is found convenient. lowing table from Hallopeau exhibits at a glance the present information regarding the nature and relations of tumors:

I. Simple Tumors.

1. Connective-tissue tumors.

Typical forms.	*B. Proto-typical forms.*	*C. Mixed forms.*
a.	*a.* Round-celled sarcoma.	*a.* Fibro-sarcoma.
ıa.	*b.* Spindle-celled sarcoma.	*b.* Myxo-sarcoma.
elioma.	*c.* Alveolar sarcoma.	*c.* Glio-sarcoma.
eatoma.	*d.* Giant-celled or angioblastic sarcoma.	*d.* Lipomatous sarcoma.

2. Cartilaginous tumors.

A. Typical forms.	*B. Mixed forms.*
chondroma.	Chondro-sarcoma.

3. OSSEOUS TUMORS.

A. Typical forms.	*B. Mixed forms.*
Osteoma.	Osteo-sarcoma.

4. VASCULAR TUMORS.

A. Typical forms.	*B. Mixed forms.*
a. Angioma.	*a.* Angio-sarcoma.
b. Lymphangioma.	*b.* Lympho-sarcoma.
c. Lymphoma.	

5. MUSCULAR TUMORS.

A. Typical forms.	*B. Proto-typical forms.*
a. Rhabdo-myoma.	Myo-sarcoma.
b. Leio-myoma.	

6. EPITHELIAL TUMORS.

A. Typical forms	*B. Proto-typical forms.*
a. Pavement-celled epithelioma.	*a.* Carcinoma.
b. Papilloma.	*b.* Cylindroma.
c. Cylindrical-celled epithelioma.	
d. Adenoma { acinous. tubular.	
e. Sebaceous cysts, simple and dermoid.	
f. Serous, mucous, and colloid cysts.	

7. NERVOUS TISSUE TUMORS.

A. Typical forms.	*B. Proto-typical forms.*
Neuroma.	Neuro-glioma.

II. COMPOUND TUMORS.

Teratoma.

Fibroma. Fibroma consists chiefly of fibrillary connective tissue. It exists in two forms: the hard fibroma, composed of resistant fibrous tissue like that of a tendon; and the soft fibroma, of which the structure resembles that of the subcutaneous areolar tissue. (Fig. 9.) Both

FIG. 9.



Fibroma from surface of spleen. × 350. (BRISTOWE.)

varieties grow slowly and are non-malignant. They may become inflamed and ulcerated, and undergo various degenerative processes. They usually occur in elderly subjects, and are located in the skin and in the areolar tissue beneath the integuments. They are also found in the tendons, aponeuroses, nerves, and ovaries.

Myxoma. Myxomatous tumors consist largely of mucous tissue, like that which exists beneath the skin of the fœtus, and in the umbilical cord. They contain a few round cells, spindle cells, and fibrils. (Fig. 10.) The tumor is usually developed in the subcutaneous

areolar tissue, or in the nervous system. *Hydatid moles* are similarly constituted. Sometimes the growths consist not only of mucous tissue, but also of other tissues, forming mixed tumors to which may be applied the name myxo-sarcoma, myxo-fibroma, myxo-lipoma, etc., as the case may be. Sometimes they contain cavities, and are then described as *cystic myxomas.*

FIG. 10.



Myxoma. (*a*. H. ARNOTT. *b*. CORNIL and RANVIER.)

FIG. 11.



Endothelioma of the dura mater, showing the alveolar arrangement of the cells. × 250. (HALLOPEAU.)

Endothelioma. This species of tumor has been confounded with sarcoma and with epithelioma. It consists chiefly of large flat cells

containing one or two nuclei. (Fig. 11.) Associated with these elements are sometimes found calcareous deposits, hence the term *psammoma* that has been assigned to these growths when they develop in the endothelium of the dura mater. Endothelioma is sometimes developed upon the peritoneum, and it may grow wherever endothelial tissue exists.

Cholesteatoma develops chiefly at the base of the brain, and has its origin in the pia mater. It consists of concentric layers formed of flat cells of an endothelial character.

Glioma is a benign tumor that consists of a reticulated tissue which resembles the neuroglia of the brain. It develops chiefly in the brain, spinal cord, retina, optic, and auditory nerves.

FIG. 12.



Round-celled sarcoma of lung. × 400. (PAYNE.)

FIG. 13.



Alveolar sarcoma. × 250 (GRESSER.)

FIG. 14.



Giant-celled sarcoma. × 300. (HALLOPEAU.)

Lipoma exists as a benign tumor, often multiple in number, in the subcutaneous, submucous, or subserous tissues of the body. It consists chiefly of fatty tissue.

Sarcoma. There are many varieties of sarcoma. In certain forms of the tumor it is composed chiefly of embryonic cells, constituting a *proto-typical* sarcoma. In other cases the constituent cells exhibit transitional forms intermediate between the embryonic cell and the more highly differentiated elements; such tumors are termed *meta-typical.*

Mixed forms are not uncommon, in which embryonic cells are associated with completely differentiated tissue cells.

The *round-celled* sarcoma consists of small round cells inclosed in a nearly amorphous stroma. (Fig. 12.) In the bones the round cells are sometimes separated into groups by fasciculi consisting of spindle cells, constituting what is termed *alveolar sarcoma.* (Fig. 13.) This variety closely resembles in its microscopical appearance that of carcinoma, but its alveolar spaces contain a delicate fibrillary network which is wanting in the alveolar spaces of carcinoma.

FIG. 15.



Spindle-celled sarcoma. (VIRCHOW.)

The *giant-celled variety of sarcoma* (Fig. 14) may be recognized by the presence of large polynucleated cells in its substance.

The *spindle-celled sarcomas* contain numerous fascicles of spindle-cells separated by an amorphous substance. (Fig. 15). Sometimes sarcomatous tumors contain hæmoglobin derived from extravasated blood. It is possible that such tumors have a parasitic origin, and this view is rendered somewhat probable by the retrogressive changes that are sometimes exhibited by them.

Melanotic sarcomas owe their color to the fact that they have their origin in pigmented tissues, such as the choroid, or the pigmented cells of the skin.

In many instances sarcoma occurs in association with other varieties of connective-tissue new growth. Such tumors are designated as fibro-sarcoma, myxo-sarcoma, glio-sarcoma, chondro-sarcoma, osteo-sarcoma, angio-sarcoma, lympho-sarcoma, etc.

Sarcoma is sometimes benign and sometimes malignant. The lower the grade of its organization the greater the tendency of the tumor to malignity.

Enchondroma. *Cartilaginous tumors* exhibit all the varieties of cartilaginous tissue (Fig. 16), and in many cases the cartilaginous neoplasm is associated with other forms of connective-tissue new growth, constituting chondro-fibroma, chondro-sarcoma, osteo-chondroma, etc. Enchondromatous tumors are usually benign, but sometimes they assume malignant characteristics.

Osteoma. Osseous tumors are non-malignant growths that occur usually in the bones, and occasionally in the dura mater, in the aponeuroses, and in the muscles. They consist of osseous tissue, and are of variable density. Sometimes the tumor consists of a cancellated bony substance, and is termed *spongy osteoma.* It may consist of

ordinary solid bony material, or it may be condensed and ivory-like, constituting what is termed an *eburnated osteoma*. In osteo-sarcomatous tumors the embryonic condition of the osseous cells is persistent.

FIG. 16.



Chondroma. *a*. Section of growth. × 150. *b*. Calcifying cells. × 250. (BRISTOWE.)

Angioma is a tumor that consists chiefly of newly formed blood-vessels. It may be either a simple angioma, or a cavernous angioma. The *simple angioma* is usually found upon the skin of the face in

FIG. 17.



Dilated capillaries from a telangiectatic tumor of the brain. × 150. (ZIEGLER.)

young children, constituting what is termed a *vascular nævus*. It is occasionally encountered in the mucous membranes, in the brain, the bones, and mammary glands. It consists chiefly of dilated capillaries with thick walls supported by connective tissue. (Fig. 17.)

The *cavernous angioma* is essentially a simple angioma in which the capillary vessels have become greatly distended. Such tumors are generally subcutaneous, but they are sometimes found in the liver, kidneys, spleen, uterus, bones, and muscles.

Lymphangioma consists of dilated and hypertrophied lymphatic vessels.

Lymphoma consists essentially in the hyperplasia of the constituent elements of a lymphatic gland. This must not be confounded with inflammatory enlargement of the lymphatic glands. It forms a non-malignant indolent growth, of which the glandular enlargements that accompany leukæmia and pseudo-leukæmia may be taken as a type. When the connective-tissue framework of the neoplasm exhibits excessive development, the tumor is called *lympho-sarcoma*, and it often displays malignant characteristics.

Myoma. Tumors that contain muscular elements are of two forms: *rhabdo-myoma*, a very rare species which has been observed only in the tongue and in the heart of newborn children; and *leio-myoma*,

FIG. 18.



Section through a leio-myoma. (PERLS.)

which, on the contrary, is not uncommon in the uterus (Fig. 18), prostate gland, alimentary canal, and other structures that contain smooth muscular fibres. These tumors are generally non-malignant.

Myo-sarcoma. This form, which partakes of the characteristics of muscular tissue and of a sarcomatous growth, has been occasionally discovered in the kidneys or in the testicles, where its growth is probably due to the inclusion of muscular elements during the period of fœtal development.

Epithelioma. Epithelial tumors are developed from the epithelial tissue of the integument, or from that of the glandular organs of the body. Epidermal tumors, when constituted by the proliferation of the deep cells of the epidermis, are termed *epitheliomas*. (Fig. 19.) When they proceed from the papillary structures of the skin they are termed *papillomas*.

Epithelioma occurs chiefly upon the lips, tongue, œsophagus, uterine cervix, vulva, and bladder. It consists of lobules that are separated by connective tissue. The tumor frequently exhibits a warty appear-

ance. It tends to ulcerate, and to invade the neighboring tissues, though its growth is often very tardy. Such neoplasms usually occur among old people, and are generally encountered upon the lower lip, often, apparently, as a consequence of local irritation produced by excessive smoking.

FIG. 19.



Epithelioma. *a*. Section of growth. × 250. *b*. Free cells. × 250. *c*. Free cells more highly magnified. × 450. (BRISTOWE.)

The *papilloma* is a non-malignant tumor that consists of epidermic cells developed upon a connective-tissue base that is identical in its structure with a cutaneous papilla. Ordinary warts, which are papillomatous tumors of parasitic origin, exhibit this papillary structure in a high degree of perfection.

FIG. 20.



Epithelioma of the stomach. × 300. (HALLOPEAU.)

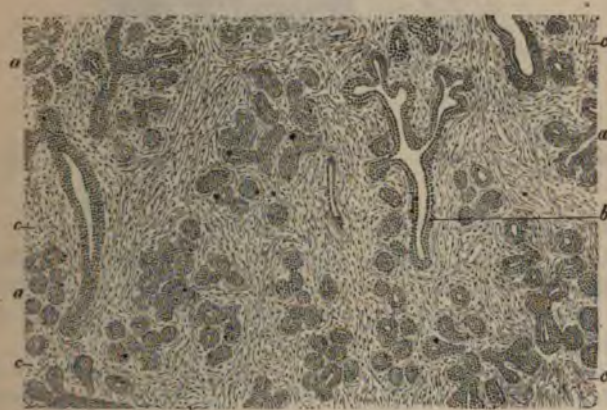
Epitheliomatous tumors are sometimes developed upon the mucous surfaces of the body. Their mode of growth and their general structure are analogous to that of the corresponding tumors of epithelial origin upon the epidermal surfaces of the body. (Fig 20.)

Cylindrical Epithelioma develops upon surfaces that are normally provided with cylindrical epithelium, *e. g.*, the gastro-intestinal mucous membrane, and the glandular ducts that communicate with the intestine, also the uterine and olfactory mucous surfaces.

These tumors invade the neighboring tissues, producing atrophy by compression; and they also perforate the bloodvessels. They sometimes undergo mucous or colloid degeneration, and they reproduce themselves in organs at a distance from the original focus of disease.

The **Adenomas** are neoplasms developed from glandular tissue. The *acinous variety* represent the glandular pockets of the parent gland. Such tumors are found in the breast, in the sebaceous and sudoriparous glands, in the parotid, and about the fauces and pharynx; they are generally of small size, and do not exhibit malignant characteristics. (Fig. 21.)

FIG. 21.



Alveolar adenoma of the mammary gland. *a*. Alveoli. *b*. Glandular duct. *c*. Connective-tissue stroma. × 240. (ZIEGLER.)

The *tubular adenoma* is composed of cylindrical cells which represent the cylindrical cells of the tubular glands in the mucous membranes. This variety of adenoma is non-malignant, and exists in the walls of the stomach, intestine, and uterus. When thus developed in the uterine cavity, it constitutes what is known as a *mucous polyp*.

The *cystic variety of adenoma* represents an exaggerated development of the glanduiar cavity of a secreting gland. The original glandular pocket becomes dilated and surrounded by thick walls that consist of cells that have in some degree departed from the original form of the glandular epithelium, but are still supported by a fundamental layer of undifferentiated glandular epithelium. The cavity of the tumor is filled with a liquid that somewhat resembles the normal secretion of the gland in which the neoplasm is developed. Similar perversions of growth are sometimes witnessed in connection with the sudoriparous glands of the skin.

Ovarian cysts are to be considered as constituting a variety of epithelioma. They are developed from the glandular epithelial investment, which puts forth processes that become hollowed and filled with liquid, like any glandular cavity whose excretory duct has been obliterated. (Fig. 22.) The cavity of the cyst becomes divided into secondary cysts

FIG. 22.



Cross-section of a multilocular cystoma from the ovary. ½ natural size. (ZIEGLER.)

through the proliferation of the epithelial lining of the tumor; and the liquid contents of these multilocular cysts contain floating epithelial cells of various form and size. Sometimes the epithelial structure of the tumor is transformed into myxomatous tissue, constituting a colloid tumor; and mixed forms are sometimes observed.

Carcinoma. A large number of the epithelial tumors are made up of undifferentiated epithelial cells that are simply agglomerated

FIG. 23.



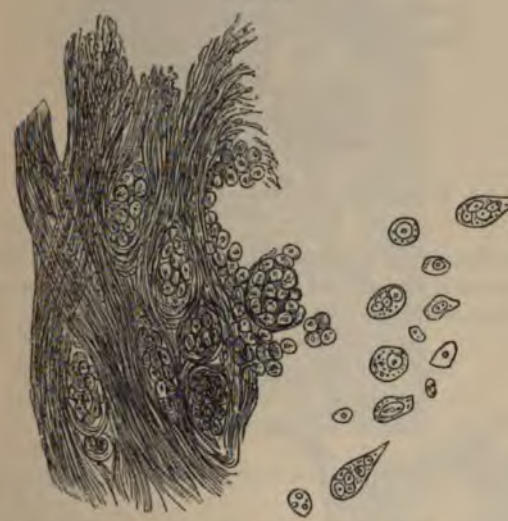
Cancer cells. × 500. (BRISTOWE.)

irregular masses, without any semblance of organization like that which characterizes adenoma. Sometimes transitional forms are observed. These atypical tumors are commonly designated by the term *cancer*.

Many forms of *sarcoma* closely resemble *carcinoma*, but their alveoli contain endothelial cells instead of the epithelial elements that exist in carcinoma.

The constituent cells of carcinoma exhibit a great variety of form, size, and structure. (Fig. 23.) They are generally very large, and contain one or more nuclei, together with granules of fat or of colloid substance. The stroma of the tumor is richly supplied with blood-vessels. The characteristic feature of carcinoma is its alveolar structure, in which the alveolar spaces are filled with epithelial elements, while the stroma consists either of fibrous tissue or of embryonic tissue. (Fig. 24.) When the alveolar walls are largely developed, and the

FIG. 24.



Scirrhus. × 250. (BRISTOWE.)

alveolar spaces are small, the tumor acquires considerable density, and is termed *scirrhus;* when the alveolar walls are very thin, and the alveolar spaces are large, the tumor is designated *encephaloid cancer.* (Fig. 25.) Sometimes the tumor is exceedingly vascular, and its blood-vessels, though very large, are provided with walls whose structure is identical with that of the capillaries; a condition that favors rupture and hemorrhage.

Colloid carcinoma is characterized by the presence of gelatinous or colloid substance in the alveoli of the tumor. (Fig. 26.)

Carcinomatous tumors are exceedingly malignant. They destroy the neighboring tissues, and extend themselves through the lymphatic channels into the neighboring lymphatic glands. In like manner their proliferating cells are transported by the blood into distant parts of the body, where they germinate and reproduce the original growth. Thus, the growth of a primary carcinomatous tumor in the stomach or in the

pancreas may be followed by the appearance of secondary carcinomatous tumors in the liver. This process of secondary growth is especially

FIG. 25.



Encephaloid cancer. × 250. (BRISTOWE.)

frequent when the primary tumor consists chiefly of epithelial elements; and for this reason it occurs more frequently in connection with encephaloid cancer than with the scirrhous form of the disease.

FIG. 26.



Colloid cancer. *a*. Fibrous stroma. *b*. Cells, degenerating. × 250. (BRISTOWE.)

The tendency of cancerous tumors to infiltrate the neighboring tissues with neoplastic elements is the principal cause of the reproduction of such malignant tumors after they have been excised. The

germinal elements that remain in the unremoved tissues seldom fail to reproduce the disease.

Cylindroma. A rare form of mixed tumor closely resembling carcinoma has been described under the name of *cylindroma*. It consists of alveoli containing cells like an ordinary carcinoma; but among the cellular contents of the alveoli are developed translucent, homogeneous, spherical masses that resemble colloid substance and manifest a tendency to replace the normal cellular structure.

Neuroma is a rare species of neoplasm. It may develop in the white or in the gray substance of the brain, where it sometimes attains to great magnitude.

FIG. 27.



Plexiform neuroma from the sacral region. Natural size. (P. BRUNS)

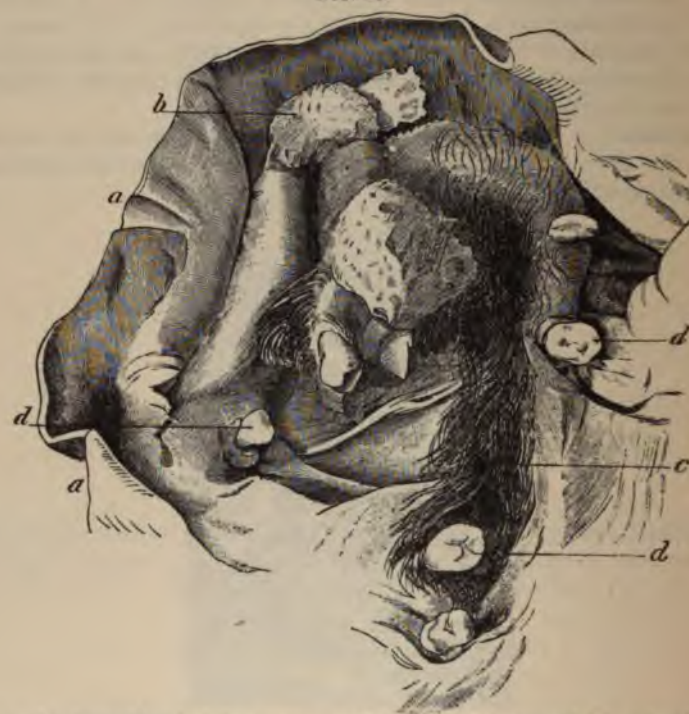
The so-called *neuromas* that develop upon the peripheral nerves are, usually, either examples of *fibroma* or of *myxoma;* they sometimes, however, contain nerve fibres. Occasionally a nerve exhibits multiple enlargements that suggest a resemblance to the venous dilatations observed in varicocele (plexiform neuroma). (Fig. 27.)

Besides the neuromatous tumors of fibrillary structure, neuromas that are composed of ganglionic cells have been observed in the brain, in the ovary, and in the testicle.

Teratoma. This term is employed to designate congenital tumors that contain fœtal structures, such as bones, teeth, hair, skin, etc. Among these tumors are also included *dermoid cysts.* (Fig. 28.) The internal surface of such cysts exhibits an organization closely resembling that of the skin. The contents of the cavity are made up of sebaceous matter, hair, epithelial elements, and sometimes other fœtal structures. The majority of these tumors are considered examples of the inclusion of rudimentary fœtal elements that have been misplaced from their normal situation. When the tumor occupies the ovary, it is supposed

that two ovules may have been simultaneously fecundated, but that during the process of development one of them became enveloped in

Fig. 28.



Portion of a dermoid cyst of the ovary. *a*. Cyst wall. *b*. Masses of fat and cutaneous tissue *c*. Hairs. *d*. Teeth. Natural size. (Ziegler.)

the substance of the other, where its further progress could only be incomplete and imperfect.

CHAPTER VI.

DISORDERS INDUCED BY DISTURBANCES OF THE CIRCULATION.

When an excessive quantity of blood is for any reason supplied to an organ or tissue, the condition is termed *hyperæmia*; but when, on the contrary, the blood-supply falls below the normal amount, local *anæmia* is established.

When hyperæmia is caused by an inordinate afflux of blood, it is termed *active hyperæmia*. When it is due to an obstruction to the passage of blood through the veins, it is termed *passive hyperæmia*.

Active hyperæmia frequently exists as a consequence of relaxation of the arterial walls under the influence of nervous excitement, as may be witnessed in the act of blushing. Similar vascular dilatation frequently occurs in connection with diseases of the nervous system, or as a consequence of reflex excitement.

Passive hyperæmia occurs whenever capillary stasis is produced by an obstacle in the course of the venous circulation. A typical example of this is furnished by cirrhosis of the liver, in which disease the hepatic capillaries are subjected to pressure, which hinders the outflow of blood from the portal system. The abdominal organs become, therefore, the seat of passive hyperæmia. Still more extensive is the passive hyperæmia that is caused by those cardiac lesions which prevent the rapid flow of blood from the venæ cavæ into the right side of the heart. When the mitral valve, for example, is deficient, passive hyperæmia involves the entire pulmonary circulation and the whole venous system.

A tendency to stagnation of the blood is often exhibited as a result of chronic relaxation of the venous walls. This may be observed as a consequence of malnutrition, anæmia, and protracted illness. The hypostatic congestion that occurs in the dependent portions of the lungs during the later stages of typhoid fever belongs to this variety of passive hyperæmia.

When passive hyperæmia persists for any length of time, a serous transudation often occurs through the walls of the capillaries and veins. The liquid that is thus poured forth contains less albumin than the plasma of the blood, and a few of the corpuscles of the blood are sometimes visible. The transudation accumulates in the interstices of the tissues, where it constitutes *œdema;* when the serous cavities of the body are thus occupied it is termed *dropsy.* Sometimes a tendency to hemorrhage is coincident with the process of transudation. Such effusions are not dependent upon mere stagnation of the blood; the vascular wall is in an unhealthy state, and its innervation is also defective. Under such circumstances, passive hyperæmia and a general cachexia are favorable to the process of transudation. The retention of the effusion in the interstices of the tissues and in the serous cavities is due to a morbid condition of the lymphatic channels through which surplus liquids should be normally returned to the general circulation. Thus may be explained the œdema and dropsy that accompany chronic nephritis, scurvy, tuberculosis, cancer, etc.

Leaving out of consideration those hemorrhages that are occasioned by violence, and by alterations in the atmospheric pressure, such as are observed during balloon ascensions or upon the summits of high mountains, it should be noted that hemorrhage is frequently caused by an increase of intra-vascular pressure. It is in this way that subcutaneous hemorrhage is produced during an epileptic convulsion; and active hyperæmia from any cause is often accompanied by a vascular rupture. Such lesions of the vascular walls are especially liable to occur when the vessels are in a condition of disease; atheroma, endarteritis, peri-arteritis, and miliary aneurisms are frequent causes of such an accident. Obstacles in the course of the circulation often occasion hemorrhage through changes in the nutrition of the vascular walls that

are dependent upon stagnation of the blood. For this reason the formation of an infarct in any organ of the body is usually accompanied by hemorrhage. Considerable alterations in the quality of the blood through infective processes frequently occasion such change in the nutrition of the vascular walls that hemorrhage occurs. This may be witnessed in the hemorrhagic forms of the infective diseases—scurvy, purpura, snake poisoning, and occasionally after the administration of iodide of potassium. It is also probable that hemorrhage may sometimes occur as a consequence of violent disturbance of the nervous system, and that the visceral hemorrhages which have been observed in connection with certain lesions of the brain are thus explained.

Local anæmia in an organ or tissue may be simply the local consequence of general anæmia; but under such conditions the consequences are less formidable than when local anæmia is produced by mechanical causes, such as the occlusion of a vessel by thrombus or by embolism. Sometimes very serious disturbances are produced by transient functional anæmia, such as may be witnessed when the brain is rendered temporarily anæmic in syncope. In certain morbid conditions of the nervous system transient local anæmia may be observed in the extremities, or elsewhere, as a consequence of spasmodic occlusion of the arteries that lead to the affected part; such phenomena are not uncommon in hysteria. If a similar occlusion, by reason of atheroma, embolism, or other permanent obstruction, should be produced, a visceral infarct, or complete gangrene, would occur, according to the location of the obstruction.

The term *thrombosis* signifies the more or less complete obstruction of a bloodvessel by intra-vascular coagulation of the blood during the lifetime of the patient. Such clots are formed as a consequence of alterations in the vascular wall, accompanied by destruction of the endothelium; or they may be produced by the lodgment of an embolus; or by changes in the quality of the blood. Stagnation of the blood is also favorable to the formation of a thrombus. Such clots are therefore not uncommon in cardiac and arterial diseases, and in cachectic conditions of the body. *Embolic obstruction* of the circulation is caused by the entrance of solid bodies of every kind into the channels of circulation. Such bodies are usually detached from previously existing thrombi within the bloodvessels, or they may be loosened from the vegetations that form upon the inflamed valves of the heart in endocarditis. Sometimes cancerous or tuberculous masses find their way into the bloodvessels. The capillaries of the lungs or of the brain are sometimes obstructed by globules of oil that are derived from the marrow of bones that have been fractured by violence. In like manner the floating fragments of a bacterial colony are not unfrequently arrested in the capillary vessels to which they have been transported from the original centre of infection, thus producing an extensive diffusion of infective disease. In this way the dissemination of miliary tubercles, the formation of pyæmic abscesses, and other similar facts, may be explained.

In the majority of cases the formation of a thrombus is followed by its organization. The endothelial cells of the vascular wall proliferate

and penetrate its substance, which also becomes permeated by capillary bloodvessels that apparently proceed from the nutrient capillaries of the vascular wall itself. In this way a low form of organization is effected, and the adjacent walls of the bloodvessel become thickened and condensed. The occluded vessel is finally transformed into an impervious, cord-like mass of connective tissue. A collateral circulation is established through neighboring vessels, or through the dilatation of the nutrient vessels in the vascular wall. Sometimes the thrombus retracts sufficiently to permit the return of blood to its original channel; or the newly organized mass may become hollowed out in such a way as to give passage for the blood through a series of communicating cavities in the thrombus itself.

Dropsy. The interstices of the tissues and the serous cavities of the body contain in health a certain amount of fluid by which the internal surfaces of the body are kept moist, and nutriment is furnished to the cellular elements of the tissues. If the amount of this fluid exceeds the quantity ordinarily needed for these purposes, it constitutes *œdema* when accumulated in the interstitial spaces, or *dropsy* when distending the serous cavities. Such morbid effusions closely resemble in constitution the blood serum, and contain very few of the cellular elements of the blood or of the constituents of fibrin. The principal causes of such transudation are *arterial dilatation* accompanied by deficient innervation of the part; *obstruction* in the outlets of the veins or of the lymph channels; *alterations in the walls* of the capillary vessels; *insufficient elasticity* of the tissues; and an *abnormal composition* of the *blood.*

When dropsy tends to become generalized it is called *anasarca;* when the transudation is localized, as in the areolar tissues of the eyelids or scrotum, it is called *œdema.*

The following definitions will be found of service in the study of local dropsies:

Hydrocephalus: Dropsy of the ventricles of the brain.

Meningocele: A protrusion of the membranes of the brain through a congenital opening in the skull.

Hydrorachis: Dropsical accumulation within the central canal of the spinal cord.

Hydrophthalmus: Dropsy of the eyeball.

Hydrothorax: Dropsy of the pleural cavity,

Hydropericardium: Dropsy of the pericardium.

Hydroperitoneum or ascites: Dropsy of the peritoneal cavity.

Hydronephrosis: Dropsy of the pelvis of the kidney and ureter.

Hydrometra: Dropsy of the uterus.

Hydrosalpinx: Dropsy of the Fallopian tube.

Hydrarthrosis: Dropsy of the joints.

CHAPTER VII.

CONTAGION AND INFECTIVE DISEASES.

It has been known from time immemorial that certain diseases are produced by the transmission of matter of some sort from a diseased person to a healthy individual. Various skin diseases are thus propagated. Witness the common form of scabies that is spread by the migration of the itch mite from person to person. Intestinal worms may be transmitted from one animal to another; and various protozoa, such as the amœba of dysentery and of tropical diarrhœa, or the plasmodium malariæ, may in like manner excite disease in the human organism. A considerable number of diseases, therefore, are dependent upon *parasitic causes*. It will be shown that the phenomena of *inflammation* may be caused by chemical products yielded by certain microscopical vegetable parasites known as the pyogenic cocci. With the progress of investigation it has been discovered that certain other diseases are produced by the entrance and activity of other minute vegetable parasites which invade the tissues and disorder the functions of the organism, thus producing what are termed *infective diseases*.

A large amount of time and ingenuity was formerly expended in the attempt to establish a distinction between the terms *contagion* and *infection*, but it is now recognized that there is no essential difference between a contagious process and an infective process. A disease was said to be *contagious* when, like syphilis or scabies, it was caused by direct contact with the bearer of disease; it was said to be *infective*, when, like typhoid fever, malarial fever, or influenza, it was contracted through the medium of the air that was breathed or the water that had been drunk by the patient. Certain diseases, like malarial fever, were said to be of miasmatic origin: the term *miasm* being employed to indicate any volatile poison that might in some way arise from the earth into the air. But in all such cases it is now recognized that something has entered the body of the patient, and that the disease with which he suffers is nothing more or less than the disorder of function that is caused by such invasion. The invasive agent is in general terms designated a *contagium* or *contagion*.

The physical characteristics of a contagium may be exceedingly various. It may be an egg, like the ovum of a tapeworm; it may be a microscopical fungus, scarcely visible with the highest powers of the microscope; it may be a solid substance, like the scab from the pustule of smallpox; it may be a liquid, like the lymph or pus from a chancre; or it may be a volatile substance, like the contagia of influenza, or of dengue. It may be capable of remaining inert in the dust of the earth, like the bacillus of tetanus; it may be miscible with water, like the typhoid bacillus; or it may rise with watery vapor into the atmosphere, like the protozoon of malaria.

A contagion may operate upon the external surfaces of the body, among the epithelial cells of the skin, after the manner of the itch mite, or the microphytic causes of other cutaneous diseases. It may enter the current of the blood through the respiratory organs, like the tubercle bacillus; it may penetrate the walls of the alimentary canal, like the trichina spiralis, or the typhoid bacillus; and it may find access to the circulating fluids of the body through wounds or abrasions upon any of its surfaces.

Parasitic contagia which thus attack the cutaneous surfaces of the body, when of animal character, are termed *epizoa;* when they belong to the vegetable kingdom they are termed *epiphytes.* Animal and vegetable parasites that invade the tissues and cavities of the body are termed respectively *entozoa* and *entophytes.*

It has been shown by careful investigation that the majority of contagions consist either of minute parasitic plants, called *microphytes*, or of soluble chemical substances that are secreted by them. These microphytes bear to the corresponding diseases a relation very similar to that which exists between the pyogenic microphytes and the process of inflammation. This relation has been completely demonstrated in so large a number of the infective diseases that it is impossible to exclude the inference that all diseases of an infective character are thus produced. The minute vegetable organisms to which the virulence of the different contagia is due belong to the *fungi*, a class of plants of which the yeast plant, the mould that occurs upon stale bread, and the ordinary mushroom, are conspicuous members. These plants are destitute of chlorophyl, consequently they are unable, like the more highly organized plants, to derive nourishment from carbonic acid gas and other inorganic compounds that contain carbon. They obtain their food from substances of an organic character in which carbon has been already combined with other elements, and has become a constituent of the living tissues of a plant or an animal. When the fungus feeds upon *dead organic matter* derived from plants or animals, it is called a *saprophyte;* such are the moulds and mushrooms that occur upon the trunks of dead trees. If the fungus vegetates in or upon the tissues of a living plant or animal, it is termed a *parasite.* Of these the most familiar examples are the microphytes by which infective diseases are excited.

Among the parasitic fungi are other sub-classes in which are included the microphytes that are capable of exciting disease in the body of an animal.

1. The *moulds* are the most conspicuous and highly organized of these three classes. A piece of mouldy bread perfectly exhibits their mode of growth and structure. With a magnifying glass of low power it is very easy to observe their growth and their rudimentary inflorescence—anticipating, as it does, the far more elaborate floral organs of the higher plants (Fig. 29) Among these moulds are found the parasitic plants that cause ringworm, pityriasis, and herpes tonsurans.

2. The second class of pathogenic fungi is represented by the parasite that grows in the mouths of unhealthy infants, where it produces a disease called *thrush.* This fungus is usually described as a species of

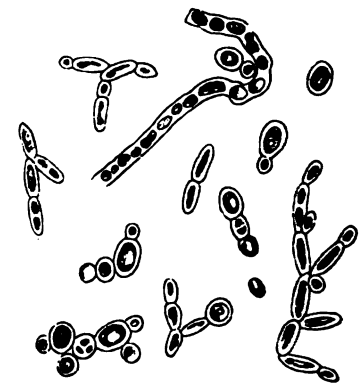
the genus saccharomyces, of which the ordinary *yeast plant* is probably the best known species (Fig. 30). The members of these two classes are saprophytes, *i. e.*, they derive their nourishment from dead or dying tissues. Accordingly they cannot flourish upon a healthy cutaneous or mucous surface. They invade the skin or the mucous membrane only after it has become degraded through imperfect hygienic conditions from the normal standard of health.

FIG. 29.



Mucor corymbifer. *a*. Aërial processes. *b*. Mycelium vegetating beneath the surface of the gelatin. *c*. Fruit stalks. *d*. Sporangia. × 100. (ZIEGLER.)

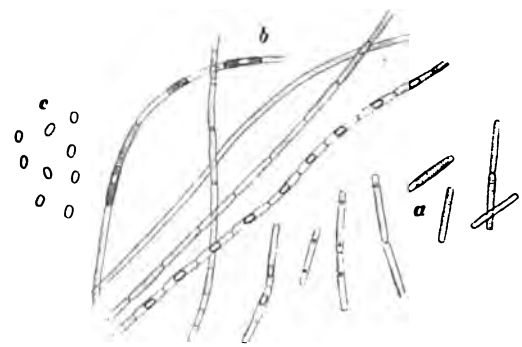
FIG. 30.



Yeast fungus. × 500. (BRISTOWE.)

3. The majority of the pathogenic microphytes constitute the subclass of fungi known as *bacteria*. These are minute unicellular organisms which consist of a usually colorless protoplasm, surrounded by a delicate membrane that corresponds to the wall of an ordinary

FIG. 31.



Bacilli anthracis. × 500. *a*. Rods. *b*. Filaments in different stages obtained by cultivation. *c*. Spores. (BRISTOWE.)

cell. Sometimes minute granules and apparently empty spaces are visible in the protoplasmic contents of the organism; and under certain conditions of nutrition they are capable of producing spores, which are analogous to the seeds of higher plants (Fig. 31); but under other

conditions propagation is effected by the division of each structure into two or more perfectly organized bodies that possess all the characteristics of the parent cell.

These bacterial organisms are frequently surrounded by a gelatinous envelope, and they are also sometimes provided with delicate hair-like processes, or flagella, by the aid of which the microphyte is capable of moving itself. This is especially true of the rod-like bacilli, many of which are capable of very rapid movement.

Bacteria may exist in a state of isolation, but those species which are provided with a gelatinous envelope usually grow in colonies of considerable size, forming clusters like the spawn of a frog. Such groups of bacteria are termed *zooglea.*

The species of bacteria are very numerous, but they may be grouped, morphologically, into three sub-genera: 1. *Micrococcus;* 2. *Bacillus;* 3. *Spirillum.* It has been ascertained that with certain exceptions these forms are interchangeable, so that by varying the constitution of the nutrient medium in which the microphyte is developed, it may be made to assume the form of a micrococcus, of a bacillus, or of a spirillum. Mere form alone, therefore, does not suffice to distinguish different bacteria from one another; it is necessary to study their mode of growth under various conditions, and their pathogenic properties when introduced into an animal body. The following are the principal characteristics of the infective bacteria :

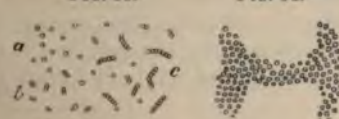
1. The members of the sub-genus *micrococcus* are minute spherical bodies, of which the length of the largest seldom exceeds one-seventh of the diameter of a red blood-corpuscle. They may be distinguished from minute particles of albumin or of fat by their resistance to the action of dilute acids, alkalies, alcohol, and ether. They are colored by aniline-violet, and do not readily part with the dye under the influence of decolorizing agents.

FIG. 32.



Diplococcus pneumoniæ. (HALLOPEAU).

FIG. 33. FIG. 34.

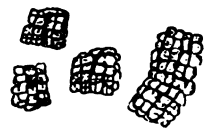


Streptococcus. Staphylococcus.
(HALLOPEAU.)

The manner in which micrococci are aggregated exhibits considerable variety (Fig. 32). When united in pairs they are called *diplococci;* when arranged in the form of a chain (Fig. 33) they are called *streptococci;* when grouped in a cluster (Fig. 34) they are known as *staphylococci.* Sometimes they are grouped by fours or by multiples

of four, of which the (Fig. 35) *sarcina*, sometimes found in the fluids of the stomach, and the *tetrageni* (Fig. 36) that vegetate in the pus of pulmonary cavities, afford examples.

FIG. 35.



Sarcina ventriculi. × 400. (ZIEGLER.)

FIG. 36.



Micrococci grouped in cubes (merismopedia) from a softening infarct in the lungs. × 500. (ZIEGLER.)

2. The *bacilli* are slender rod-like structures of variable proportions (Fig. 37); some of them are exceedingly short and thick, while others are very long and slender.

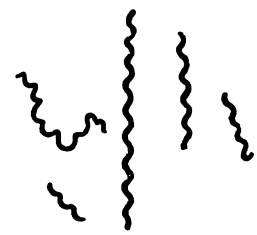
3. The spirilla or spiro-bacteria exist either in the form of short curved rods, or they may develop to considerable length, characterized by a spiral or corkscrew shape. (Fig. 38.).

FIG. 37.



Bacilli of leprosy. (NEISSER.)

FIG. 38.



Spirilla of relapsing fever. × 500. (BRISTOWE.)

Pathogenic bacteria that originate and are propagated outside of the body are called *ectogenous bacteria;* such are the contagious microphytes of pyæmia, of typhoid fever, and of cholera. When they grow and multiply only in a living organism, they are termed *endogenous*, *e. g.*, the bacilli of tuberculosis and of leprosy. In the case of cholera, and of some other infective bacteria, the contagion cannot be transmitted directly from one person to another, but it must undergo a certain form of elaboration outside of the body before it can act again as a virulent agent.

Like other plants, many of the bacteria can exist only in certain countries. Thus cholera does not become domesticated outside of India, and the yellow fever prevails continually only around the Gulf of Mexico. Diseases that are thus permanently located in a given territory are termed *endemic diseases;* while diseases that are observed only occasionally, as a consequence of importation and temporary incidence, if they prevail extensively in a community, are termed *epidemic diseases*. Thus yellow fever is endemic in Havana, but epidemic in

New Orleans or Memphis. An endemic disease that prevails moderately, may, under certain conditions, acquire great power of extension, exhibiting the features of an epidemic, *e. g.*, cholera, always prevailing endemically along the banks of the lower Ganges, may become epidemic and spread throughout the entire population of vast districts in the peninsula of India. When an epidemic disease thus attacks a large proportion of the inhabitants of a country, it is said to be *pandemic.*

The causes of these differences in the behavior of disease-producing bacteria are numerous and complicated. In the first place their growth is largely dependent upon the *temperature* of the air and of the water. Yellow fever prevails only in warm climates, or during the warm season of the year within the temperate zone. The tubercle bacillus multiples only at the temperature of the human body. The majority of bacteria preserve their vitality below the freezing-point of water. Typhoid bacilli may live for months inclosed in a cake of ice. On the contrary, an elevated temperature is quickly fatal to their existence, though the spores of certain bacilli may endure a temperature above that of boiling water for a number of minutes. Though it is true that certain infective diseases, like dysentery and typhus fever, sometimes rage with great severity during the winter months, it is largely due to the fact that cold weather causes the accumulation of filth and foul air in the unventilated habitations of the poor, thus favoring the development of disease. As a general rule it may be asserted that warmth and moisture favor the growth of bacteria precisely as they favor the growth of more highly organized plants.

It is a matter of observation that the growth and multiplication of bacteria is largely dependent upon the *chemical characteristics of the soil and water* in which they are placed. Slight differences in these particulars determine their multiplication or their destruction. It is for this reason, undoubtedly, that yellow fever is endemic only in the Gulf of Mexico, and cholera only along the borders of the Ganges and other Indian rivers. In like manner, the possibility of bacterial infection of the human body is in great measure determined by the condition of the tissues that furnish the soil in which these microphytes must vegetate. Careful laboratory experiments have shown how dependent is bacterial growth upon the presence or absence of certain mineral constituents in the substances that serve as media for their culture and growth. The presence or absence of acids and alkalies is a matter of great importance, since bacteria cannot grow in an acid medium, though moulds may flourish in the presence of a dilute acid. The mould *aspergillus niger* requires not less than a dozen chemical substances for its complete fertilization. If deprived of any one of them, the luxuriance of the vegetation is greatly diminished. An almost infinitesimal quantity of nitrate of silver or of corrosive sublimate suffices to destroy the life of a microphyte—an excellent illustration of the powerful germicidal properties of these salts.

The growth of bacteria is greatly influenced by the presence or absence of *free oxygen.* Certain bacteria require an abundance of oxygen, while others flourish best in an atmosphere or medium that does not contain the gas. Microphytes that require oxygen are called

aërobic; those which flourish without oxygen are termed *anaërobic.* The infective parasites that flourish in animal tissues are anaërobic. It has been observed that when the yeast fungus is furnished with an abundant supply of oxygen it grows luxuriantly, but yields less alcohol than when the supply of oxygen is greatly restricted. In like manner the poisonous secretions of other microphytes exhibit different degrees of virulence according to the amount of oxygen with which they are supplied.

It thus becomes possible to understand why infective diseases do not prevail alike in all countries and at all seasons of the year, and why certain individuals are susceptible to an infective disease, like cholera, typhoid fever, or tuberculosis, while others, who live perhaps in the same family, escape with perfect immunity. It also explains why certain infective diseases attack certain animals, while other species escape; thus anthrax prevails among sheep, cattle, rabbits, and human beings, but does not attack the horse or the dog; syphilis prevails among human beings, but is unknown among the lower animals; typhoid fever invades the human species, but can be only with great difficulty inoculated upon any of the lower animals. These differences in the susceptibility of the tissues of different animals and of different individuals constitute what is termed *receptivity.* The differing degrees of receptivity that are observed are undoubtedly due to minute differences in the chemical composition of the liquids and solids of each individual body. It is to the departure from the normal composition and constitution of the tissues, producing what is known as scrofula, that must be referred that heightened receptivity for the tubercle bacillus which characterizes the victims of tuberculosis; and it is to the different composition of the tissues and liquids of the body at different ages, and under varying conditions of life, that corresponding variation in susceptibility to disease must be ascribed.

Considerations of this character render it possible to understand how the receptivity of the individual may be heightened by the operation of *causes that interfere with the normal functions of the tissues.* Thus excessive heat or cold, hunger or thirst, fatigue or the occurrence of trifling maladies, may temporarily modify the processes of nutrition, assimilation, secretion, and excretion, so that the fluids of the body undergo an appreciable change in their composition, which may favor the invasion of a parasitic contagion. The recent occurrence of one infective disease may thus favor the attack of another, as may be frequently witnessed when tuberculosis promptly follows a course of measles or of typhoid fever.

On the other hand, the receptivity of an individual may be diminished by the operation of causes that favor the healthy nutrition of the tissues. In the case of many infective diseases receptivity is diminished by their occurrence. Thus measles, scarlet fever, typhoid fever, smallpox, and varicella, leave the body in a condition of diminished or utterly extinguished receptivity for their contagion. This diminution of receptivity extends also to the offspring of such patients. Thus smallpox, scarlet fever, measles, yellow fever, and other infective diseases, are least fatal among the descendants of a people among

whom those diseases regularly prevail. The *immunity* that is thus displayed by certain individuals under certain conditions, has been shown to be due to the quality of the serum of the blood and other liquids in the tissues of the body. These liquids contain albuminous compounds which are destructive to the vitality of bacteria. In certain animals the immunity against particular infective bacteria is complete so long as their liquids contain a sufficient quantity of the antidote to bacterial growth; and by injecting into the circulation of an animal that is receptive to certain contagia the serum from the blood of an animal that possesses immunity against such infection, the susceptible animal may acquire immunity, and may escape the consequences of an inoculation that would have been otherwise fatal. Thus if the serum of a white rat, which is insusceptible to anthrax poison, be injected into white mice, which are naturally very susceptible to anthrax, they will acquire perfect immunity, and can be inoculated with anthrax poison without any unfavorable results.

Before proceeding further in the study of immunity, it is necessary to recall the manner in which bacterial poisons invade the body and disorder its functions. It has been already remarked that these microphytes grow and multiply like other plants. Their multiplication is usually effected by a process of simple *division*, which proceeds with such rapidity that under favorable conditions they may double their number every twenty minutes. At this rate they may increase in number many thousand-fold in the course of a few hours. Another mode of propagation consists in the *formation of spores* within the protoplasm of the minute organism; these, under favorable circumstances of warmth and moisture, are developed into microphytes like those from which they were produced. These spores possess great vitality, and are not disorganized at ordinary temperatures. They may be exposed for many hours to a dry heat considerably above that of boiling water without destruction.

The rapid rate of multiplication that characterizes certain bacteria renders it possible for them to interfere with the functions of animal tissues by their overwhelming presence, thus producing mechanical obstruction in the bloodvessels and lymphatic channels of the body. In anthrax and some other diseases, capillary embolisms, renal infarcts, and mechanical injuries of the vascular walls may be thus explained. These obstructions, however, do not occur in the majority of infective diseases, since such excessive proliferation of microörganisms does not commonly occur in the tissues.

Like other plants, bacteria require nourishment. This they procure from the liquids in which they grow, and by such abstraction of nutriment they may considerably interfere with the nutrition of the normal tissues. They also secrete certain substances, of the nature of diastase, which act upon the neighboring tissues, and modify the alimentary principles which they contain, so that they become fitted for bacterial food. It is in the laboratory a matter of common observation that starch is thus transformed into glucose, while albuminoids are converted into peptones, and urea into carbonate of ammonia. Besides these familiar examples of the effects of bacterial action, it has been ascer-

tained that they secrete poisonous substances, and transform harmless albuminous matter into deadly *toxines*. The substances that are thus produced through the activity of bacteria are quite numerous. Besides sulphuretted hydrogen and sulphide of ammonium, certain volatile fatty acids and numerous alkaloids are produced that are quite analogous to the alkaloids contained in the tissues of more highly organized plants. The soluble poisons that are described under the name of *ptomaïnes* have a similar origin, and their deadly quality has been frequently tested. When they find their way into the body of a healthy animal they produce dilatation and irregularity of the pupils, disturbances of the heart, muscular relaxation, convulsions, and death. All these products of bacterial growth are well defined chemical compounds, and the action which they produce upon the tissues of the body is a chemical reaction. It is now admitted that the majority of the disorders that are produced by the entrance of bacteria into the body are due to the formation and diffusion of these chemical poisons. It will be shown, in connection with the study of inflammation, that the inflammatory process is consequent upon the reaction of the tissues under the influence of chemical poisons that are secreted by the pyogenic bacteria. An analogous reaction occurs in connection with every form of bacterial invasion when the tissues are not absolutely overwhelmed by an excess of their poisonous secretions. When the animal tissues are excited by moderate doses of an infective poison they are stimulated to the production of a counter-poison, or *anti-toxine*, as it is frequently called. It is to the presence of such counter-poisons or anti-toxines in the blood and liquids of the body that *immunity* is due. When the anti-toxine is sufficient in quantity and in vigor, bacterial invasion cannot occur, for the bacteria are destroyed as fast as they enter the body. When this condition exists as an original quality of the blood, it constitutes what may be designated as *natural immunity*. It is to the production of such counter-poisons that the limitation of bacterial diseases of short duration is probably to be ascribed. The infective process is itself the stimulus that excites the tissues to the production of the antidote, and so soon as it has been produced in sufficient quantity the further proliferation of invasive bacteria ceases; they perish, and are eliminated from the body. For this reason many infective diseases are said to be self-limited. So long as the increased production of the counter-poison continues after such an experience the body is protected against a return of the disease, through the establishment of what may be termed *acquired immunity*. But if, as sometimes happens, the tissues cease to furnish the counter-poison, re-infection again becomes possible. In this way may be explained the immunity that is acquired through an attack of smallpox, scarlet fever, typhoid fever, etc., and also the occasional recurrence of these diseases in the same individual.

Artificial immunity consists in the more or less complete loss of susceptibility to a contagion through an artificial infection with the same or a similar contagion. Contagious matter, or *virus*, as it is usually termed, when transmitted in the normal way reproduces itself and the disease that is dependent upon its action; but the quality of a virus

may be artificially modified before its introduction into the body, or its intensity may be diminished by some special method of inoculation, so that the violence of its effect is reduced to a degree that admits of life and the recovery of health, after which re-inoculation with strong virus produces no effect. Immunity may be acquired *by repeated inoculations* with a potent virus, in quantity too small to produce violent reaction. By this method the tissues are gradually excited to the production of counter-poisons until they finally become tolerant of the contagion in any quantity. The *mode of introduction* also exerts a great influence upon the action of a contagion. Thus the consequences of ordinary infection with smallpox virus are far more severe than when the same virus is introduced by inoculation into the skin, because the local inflammatory reaction of the tissues apparently reduces the intensity of the virus, so that a moderate reaction results without general eruption or alarming symptoms. In like manner the consequences of tubercular infection are more severe when the contagium enters the body through the respiratory passages than when it is introduced through the skin. The consequences of ordinary tubercular or syphilitic infection, moreover, are less severe than the results of infection through the umbilical vein in fœtal syphilis and fœtal tuberculosis. Similar differences are observed in other infective diseases.

Certain contagia lose a portion of their virulence by *transmission through animals of another species.* In this way the intensity of the virus of smallpox becomes reduced or attenuated by transmission through a cow or a horse. The virus of hydrophobia may be in like manner attenuated by transmission through a series of monkeys. The virus of hog cholera may be attenuated by transmission through a number of rabbits, and the weakened virus may be then inoculated into the pig, producing in that animal artificial immunity against the effects of the original virus from which the modified form was derived. The attenuated virus of smallpox that is obtained by transmission through the calf constitutes the well-known vaccine virus that gives immunity against smallpox.

Virulent contagia become *attenuated by age;* thus, an old culture of anthrax virus is considerably weaker than a freshly prepared specimen. Similar modifications are exhibited by the virus of chicken cholera, so that by inoculation with a virus that has been thus modified immunity is produced.

Many forms of virus may be attenuated by an *elevated temperature.* By subjecting a contagion to a moderate heat, for a considerable period of time, the intensity of the poison is greatly reduced, and its inoculation affords artificial immunity against active forms of the contagion.

In like manner the influence of the *solar rays* and of *oxygen*, either free in the air or acting under pressure, serves to produce attenuation of the contagion of anthrax, chicken cholera, and other infective agents.

The process of *desiccation* is employed for the purpose of attenuating the virus of hydrophobia. The spinal cord of an inoculated rabbit is suspended in dry air; its virulence diminishes day by day until it is completely extinguished. A series of cords containing virus in a dimin-

ishing ratio may be thus prepared, and by successively inoculating an animal with virus prepared from such cords, beginning with that of least intensity and advancing to that of greatest virulence, complete immunity may be secured.

A virus may be attenuated by the *addition of antiseptics* in quantity insufficient for their destruction. In this way the virus of anthrax has been transformed into a protective vaccine by the addition of small quantities of potassium bichromate, carbolic acid, corrosive sublimate, β-naphthol, and other chemical compounds.

The relation of smallpox virus to ordinary vaccine has been already noted. By the French it is denied that vaccine virus is an attenuated smallpox contagion, but by many other observers this relationship is affirmed upon the basis of the experiments of Ceeley, Badcock, and others. There are, however, cases in which the contagion of one infective disease operates in some degree to attenuate the contagion of another infective disease. It is in this way that the virus of chicken cholera is protective against the contagion of anthrax; and probably the apparent antagonism between erysipelas and lupus may be thus explained.

The active agent in the production of artificial immunity by the methods above described is not the bacterium itself, but is to be sought in its secretions. It has been ascertained that inoculation with virus from which the infective bacteria have been removed by filtration is quite as effective as that which contains the microphytes themselves—a fact which indicates that *immunity is the result of a chemical action upon the tissues.* This action is not limited to the mere circulation of a virulent liquid in the blood and lymph of the inoculated animal. It is a process that is effected within the protoplasm of the lymph-cells of the organism, causing a modification of their structure and function that results in the production of counter-poisons by which they protect themselves against subsequent infection. This process requires considerable time; if an animal be inoculated with an attenuated virus, and then immediately re-inoculated with the unmitigated form of the virus, the ordinary malignant consequences of such an infection are exhibited. But if a period of three or four days be interposed between the protective inoculation and the subsequent virulent infection, no serious consequences are manifested; the tissues have modified their functions, and are protected.

Artificial immunity may be more or less complete according to the degree of attenuation of the protective virus. Various circumstances tend to modify the results so that, although it is possible in dealing with the lower animals whose life is short, to secure an immunity that is sufficient for a comparatively brief number of months or years, very little is known about the possibility of obtaining such favorable results among human beings. In fact, the only example of artificial immunity of which the human species has any extensive experience is the immunity against smallpox that is acquired by vaccination. It is now well known that the protective effects of such vaccination are not always permanent, and that re-vaccination should be practised every few years.

Since the study of bacteriology is yet in its infancy, much remains to be learned regarding the products of bacterial growth and their mode of action. Already it appears that the secretions of these microphytes are very complex, and that they contain substances endowed with very different characteristics. Some of these are believed to represent the poisonous energy of the virus, while others are supposed to act as protective antidotes to the first, or as special stimulants to the resistant energy of the tissues with which they come in contact. That the plasma and the serum of the blood after bacterial infection contain both toxines and anti-toxines is certain, but opinions are divided with regard to the source of the anti-toxines. In the opinion of some they are the products of bacterial secretion, while others—and this seems to be the more probable view—believe that they are furnished by the cells of the tissues which are stimulated to their secretion under the influence of invasive infection. Undoubtedly the chemistry of the future will discover methods for the separation of these different prnciples, and for the artificial production of antidotes similar to those through which the tissues provide themselves with immunity. Already the anti-toxine of the poison of tetanus, obtained from the blood of inoculated animals, has been successfully used as an antidote to the disease, both in the lower animals and in the human subject.

Passing now from the consideration of the subject of immunity to the study of the manner in which bacterial invasion of the organism is effected, it appears that when a contagion enters the body of an animal, its microphytic agents may be either disseminated throughout the organism, or they may remain localized at the point of introduction, and may thence diffuse their secretions throughout the entire body. The microbes of soft chancre, gangrene, whooping-cough, diphtheria, and some other diseases, remain fixed at the site of original infection, or extend themselves only to a very limited degree. In malignant pustule, glanders, tuberculosis, and erysipelas, the microphytes are at first localized, but subsequently become diffused by the transportation of infective emboli through the lymphatic channels and bloodvessels. The act of vaccination, and the inoculation of the contagion of smallpox, consists in the introduction of virus through a puncture in the skin, where the infective agent is at first localized, but finally invades the entire body and produces general symptoms. The period of local action constitutes what is termed the *period of incubation*. This is variable for different infective diseases. The symptoms that are manifested when the contagion has become generalized, constitute the characteristics of the *period of invasion*. These symptoms express the reaction of the nervous system and the disorders of circulation, secretion, and excretion that are produced through the direct action of the invasive poison. The consequences of such disturbance constitute the *fastigium* or fully developed stage of the disease; while the symptoms that accompany the disappearance of the contagion and the return of normal function in the tissues characterize the *period of convalescence*. In certain diseases the infective contagion apparently passes through successive stages of activity and latency; such diseases are *intermittent* or *recurrent* in their course; as, *e. g.*, certain forms of malarial fever

and relapsing fever. In certain diseases, as, for instance, smallpox and yellow fever, the symptoms of invasion are followed by a period of remission, which again is succeeded by symptoms that indicate a *secondary* or *auto-infective process*, consequent upon local reactions in the skin or internal viscera.

The *limitation* of the course of infective disease is accomplished through the acquisition of immunity. In certain cases, as in measles, scarlet fever, smallpox, etc., this is speedily acquired, and its duration is usually permanent. But against other diseases, as, *e. g.*, in diphtheria, there is either no immunity, or its duration is exceedingly brief and uncertain. In a third class of diseases, such as leprosy and tuberculosis, immunity is rarely, if ever, acquired, and the disease persists through life.

When an infective disease is self-limited and gives place to complete recovery, its contagion must be either destroyed or eliminated from the body. It is a matter of observation that in such diseases the infective bacteria rapidly disappear. They are, perhaps, in some measure absorbed and removed by the leucocytes and the cellular elements of the spleen and other tissues of the body (phagocytosis). Sometimes, as in typhoid fever, they become isolated, and for a time remain encapsulated, as it were, in certain circumscribed localities, whence they occasionally issue forth to reinfect the body, producing a relapse of the original disease. The final *elimination of bacteria* is effected through the excretory organs, especially through the kidneys, where they may be discovered in the glomeruli, in the walls of the uriniferous tubules, and in the urine itself. By their presence and by the action of their secretions, inflammation of the kidneys is frequently excited. It is for this reason that nephritis and retractile albuminuria so frequently accompany the course of infective diseases. The skin also shares in the eliminative process; hence, probably the common occurrence of eruptive manifestations which are so often witnessed during these diseases.

Besides the directly poisonous effects of bacterial invasion, it is important to note the *consequences of disturbance* in the *functions of the important viscera* of the body. Disorder of the kidneys and of the liver is especially liable to occur as a consequence either of the direct influence of infective microörganisms or their secretions. Such disorders must necessarily interfere with the efficient excretion of the waste products of tissue change. In this way the poisonous products of metabolism may be accumulated in the body, giving occasion for *auto-intoxication* of the nervous system and other vital organs. In this way delirium, coma, excessive elevation of temperature, cardiac failure, and paralysis of the medulla oblongata may be produced, and a fatal termination may be reached when otherwise recovery might have occurred. It is through analogous processes of auto-intoxication that the secondary effects of scarlatina, diphtheria, and influenza are evolved.

A process of *secondary infection* not unfrequently follows the course of a primary infective disease. The pyogenic cocci, which are always present upon the surfaces of the body, find its tissues less resistant

under the influence of the primary infection; and the consequences of their activity become apparent in the various forms of suppuration that occur during the later stages of the original disease. In this way may be explained the cutaneous abscesses and the glandular suppurations that follow typhoid fever, scarlet fever, and other infective diseases. In the same way is originated the form of pneumonia that frequently complicates influenza, typhoid fever, etc.

CHAPTER VIII.

INFLAMMATION.

It is difficult to present a brief and comprehensive definition of the term inflammation, since the process occurs under such various conditions, proceeds with such variable activity, and arrives at so many different results. It has been defined as *the reaction of the tissues to injuries that are insufficient to produce their paralysis or total destruction.* It is intimately connected with the capillary circulation, and is accompanied by extensive disturbance, not only of the movement of the liquids of the body, but of the universal processes of innervation and nutrition of the entire organism. The process is usually initiated by the entrance of certain species of bacteria into the tissues that are about to become the seat of inflammation. Of these bacteria the staphylococci, streptococci, and pneumococci are probably the most frequent exciters of inflammation. Present in the air and upon the surfaces of the body, if they find access to tissues that have been weakened by injury, they proliferate in the fluids of the part. As they grow they secrete poisons that act upon the adjacent cells, producing necrosis or atrophy of the cells among which they multiply. Around the parasitic colonies thus established are accumulated the leucocytes of the blood that have migrated through the walls of the capillaries, forming what is termed pus; while still further away from the necrotic centre is formed a zone in which there is active exudation of the plasmatic contents of the capillary vessels, and multiplication of the cellular constituents of the inflamed tissue. In this way is formed an abscess, in which the original bacterial colony constitutes the focus, while the necrotic centre becomes surrounded and infiltrated with pus corpuscles, beyond which the tissues are condensed by exudation and infiltration.

The process of suppuration may be also excited by other agents besides the poisonous secretions of bacteria. If mercury, or other irritants that have been thoroughly sterilized, be introduced subcutaneously into the tissues in such a way that bacterial infection cannot at the same time occur, suppuration follows as a consequence of the irritation that is thus excited. Each minute globule of mercury becomes surrounded by pus corpuscles. It, therefore, is apparent that the exciting agent is of a chemical character, and that it is through the chemical

activity of bacterial secretions that the inflammatory process is set up after injury and bacterial infection. It is also worthy of note that when the products of bacterial secretion are alone injected into the tissues, inflammation is often excited, just as if the bacteria themselves had been introduced into the organism. Another interesting feature that illustrates the infective character of the process by which inflammation is excited, as well as the intimate relation which it sustains to the infective process by which contagious diseases are produced, is furnished by the observation that under certain circumstances inoculation with bacterial virus will produce inflammation, as in vaccination or inoculation for smallpox; while under other conditions local reaction does not take place, and the entire organism succumbs to the generalized influence of the poison, as when smallpox is taken in the usual way. It follows, therefore, that a poison which, in excessive quantity, produces universal death of all the tissues and organs of the body, may, in moderate quantities, excite only a local reaction of an inflammatory character.

It has been also observed that the occurrence of local inflammation about the point of infection sometimes suffices to protect the organism against universal infection, as is observed in certain cases of local tuberculosis. The inflammatory reaction may be, therefore, in some degree protective against the general diffusion of contagious matter. But too often the contagion has been universally disseminated before its diffusion can be arrested by an inflammatory reaction, because the normal liquids and elements of the body are incapable of neutralizing its energy. Under such circumstances general infection takes place, either in the form of universal toxæmia, as in diphtheria; spreading inflammation, as in erysipelas; or multiple abscesses, as in pyæmia. When the reaction of the tissues is sufficient to limit the action of the pyogenic bacteria, the resulting inflammation is said to be *circumscribed*. But when the virulence of the poison is too great the resistance of the normal tissues and liquids is overwhelmed; the inflammatory process is then generalized, and is termed *diffuse*, as in erysipelas.

Inflammation may be, therefore, defined as *the result of chemical action upon the elementary parts of a tissue, through which its interstices become infiltrated with the constituents of the blood, and with newly formed embryonic cells.* In this way are produced local swelling from infiltration, change of color from afflux of blood, pain from compression and excitement of the nerves, heat and febrile disturbance of the organism from disorder of the regulative mechanisms in the nervous system. Suspension of function is frequently followed by the death and disintegration of the affected tissues, which are subsequently either isolated or extruded from the surviving portions of the body.

The *course of the inflammatory process* can be easily observed in the tongue of a frog, or in the tail of a tadpole, or in any other living translucent membrane. When such a tissue is placed under the microscope the blood may be seen moving through the vessels of the part, the colored corpuscles occupying the axis of the current, while the colorless corpuscles and the hæmatoblasts move less rapidly in the peripheral portions of the stream, in contact with the walls of the capil-

ssels. When an irritant, like nitrate of silver, is applied to such brane, its capillaries can be seen to dilate for a brief period of uring which the flow of their contents is accelerated. After a nutes the blood stream begins to move more slowly, until finally be completely arrested. During this retardation of the current orless corpuscles become adherent to the capillary wall, and pres- begin to pass through the vascular ane into the interstices outside of pillary channels. (Fig. 39.) This sation of leucocytes is due to a local upon the cement substance in the y wall by the bacterial secretions xcite inflammation. There also ap- to be exerted a certain chemical on by which the leucocytes are im toward the source of infection. In inflammation the colored corpuscles o extravasated in a similar manner. assage of the corpuscular elements blood through the capillary wall is called *diapedesis*. Attracted the central focus, the white corpuscles rapidly accumulate, permeated and swelled by the liquids of the part, and are l by the bacteria themselves (phagocytosis). If not thus para- r rendered stationary by overcrowding, they may find their way e neighboring lymphatic channels, and thus serve as vehicles for nsportation of infective matter to other parts of the body (embolic n).

FIG. 39.



Migration of white corpuscles. × 250. (RINDFLEISCH.)

le the passage of blood corpuscles into the tissues a certain of liquid from the plasma of the blood finds its way through illary walls. This contains a larger amount of albumin than is n the transudation of dropsy, though less than is contained in sma within the vessels. The liquid appears to be forced out of cular channels by the pressure that is transmitted from the heart weakened capillary walls, whose endothelial layer acts as a filter, ing the passage of certain constituents of the blood, while others ained.

cause of the stagnation of the blood corpuscles and of their n to the capillary walls is probably connected with chemical s that affect the specific gravity of the elements of the blood. id that has escaped from the bloodvessels, is termed an *exuda-* t contains the elements of fibrin, and therefore undergoes coagu- When this occurs upon a free surface, the white corpuscles and nic cells become entangled in the meshes of the fibrin, and a false ane is thus formed. Examples of this process may be observed he mucous membrane of the respiratory passages, or upon the surfaces within the thorax, or upon the serous lining of the cavi- and around the heart. (Fig. 40.) In certain cases such false anes can be stripped off, leaving almost intact the surfaces upon hey were formed. In other instances the false membrane seems artially incorporated with the external layers of the surface upon

which it is formed, so that separation cannot be effected without laceration of the structure.

When inflammation involves a free surface like that of the peritoneum, the endothelial cells that form its smooth external layer become loosened and partially detached, while the deeper layers break up and assume an embryonic character. (Fig. 41.) The nuclei of the cells multiply by division, and thus produce new cells which are added to the products of exudation. The same multiplication of embryonic cells

FIG. 40.



Fibrinous exudation. *a*. From diphtheritic membrane. × 250. *b*. From inflamed pleura. × 500. (BRISTOWE.)

FIG. 41.



Inflammation of mesentery. × 250. (CORNIL and RANVIER.)

takes place wherever inflammation attacks the deeper tissues of the body. (Fig. 42.) In this way, by exudation, and by multiplication of the elementary parts, the inflamed structure becomes swelled and consolidated.

The *heat* of an inflamed tissue is greater than the natural temperature of the part, because of the increased oxidation that accompanies cellular proliferation and growth. The temperature is also raised by the stagnation of the circulation, and the consequent retention of heat

FIG. 42.



Inflammation of cartilage. × 250. (CORNIL and RANVIER.)

which should be diffused by a normal movement of the liquids of the body. The general rise of temperature that is observed throughout the body and the acceleration of the movement of the heart constitute the principal signs of *fever*, a condition that is dependent upon a disturbance of the regulative apparatus by which the liberation, distribution, and radiation of heat, and the processes of assimilation, secretion, and excretion should be normally controlled.

The inflammatory process is, therefore, an exaggeration of the processes that have been previously described as *hypertrophy* and *hyperplasia*. Hypertrophy consists in the enlargement of the normal elements of a tissue under the influence of excitement. Hyperplasia consists in the proliferation of the constituent cells of a tissue under similar circumstances of excitement. Inflammation is all this, and something more. It consists not merely in the multiplication and swelling of cellular elements within the tissue, but in the infiltration of the part with the products of exudation from the capillary vessels. The inflammatory process itself may exhibit varying degrees of activity and exudation. In all cases there is an accumulation of leucocytes at the seat of inflammation, but they may be so generally diffused among the other elementary parts of the tissue, and the amount of coagulation may be so great that only a general swelling and consolidation of the part can be distinguished. But when the inflammatory process reaches a high degree of virulence, the movement of leucocytes toward the central focus becomes so active, and the coagulative process is so little effective that *colliquative necrosis* takes place; a considerable cavity is formed in the tissues and is occupied by the products of suppuration,

FIG. 43.



Pus-cells. × 500. *a*. Ordinary appearance. *b*. Showing amœboid movements. *c*. After addition of acetic acid. *d*. Undergoing fatty degeneration. (BRISTOWE.)

constituting an *abscess*. The pus that is thus formed is a more or less fluid substance that consists largely of the liquefied and degenerated plasma that previously occupied the interstices of the inflamed tissue. In this fluid float pus corpuscles, which closely resemble the colorless blood corpuscles from which many of them have been transformed. (Fig. 43.) They are often larger than the original leucocytes, because swelled by imbibition. They are often mixed with other cell structures that have been discharged from the neighboring tissues into the purulent fluid. These elements are no longer capable of organization, but are in a state of degeneration and disintegration.

When pus is produced upon the free surface of a mucous membrane the process is termed *catarrhal suppuration*. When pus is accumulated within a closed cavity, it constitutes an *abscess*. Pus corpuscles are frequently found in exudations within the serous cavities of the body, which thus become converted into abscesses. When the pus corpuscles are numerous, the purulent liquid is thick, creamy, and does not exhale any disagreeable odor. Such pus is said to be *laudable*. If air containing the germs of putrefaction finds entrance into a pus cavity, decomposition of the liquid takes place, and the corpuscles

undergo rapid disintegration, together with the liberation of offensive gases. When the serous constituents of pus are predominant, pus loses its laudable characteristics, and more or less closely resembles thin, turbid serum (ichorous pus). Sometimes the liquid is contaminated with blood in various stages of decomposition (sanious pus). When mixed with mucus upon the surface of the mucous membrane, the exudation is said to be muco-purulent in character. If inclosed in a cavity from which it cannot escape, the corpuscles may be removed by disintegration and absorption of the débris through the lymphatic vessels. It is probable that the cells of contiguous living tissues may take some part in this process of absorption. Sometimes the serous portion alone is thus removed, and the corpuscles become condensed into a caseous mass which sometimes may become finally infiltrated with calcareous salts.

Under certain circumstances, instead of proceeding to suppuration *the products of inflammation become organized.* This process may be observed in the inflammation of connective tissue, such as occurs in cirrhosis of the liver, where there is great multiplication of the connective-tissue cells of the organ, without formation of pus, or immediate death of the inflamed structures. But when a solution of continuity has occurred, such as may be observed in a flesh wound, the process of repair is somewhat different. The reparative process may occur without inflammation, if the wound be not infected by the pyogenic bacteria. A clean incision, if speedily closed, heals by *first intention.* There is an exudation of plasma upon the surfaces of the wound, giving them a glistening appearance. If, now, these surfaces be placed in close apposition, they become adherent, and healing takes place by immediate union; new cells sprout from the contiguous surfaces of the wound, and fill the intervening space with newly formed tissue elements by which the injury is obliterated, and within a day or two union is complete.

But if the apposition of the divided surfaces be delayed for twenty-four or thirty hours, the original glossy surface will become transformed into a grayish film that consists of lymph corpuscles and leucocytes imbedded in a granular, fibrinous plasma. If, now, the opposite surfaces of a wound in such a condition be drawn together, they become adherent in the course of two or three days, and their union will be completed in two or three weeks. In this case, a preliminary adhesion of the opposite surfaces is effected through the medium of the plasmatic exudation, into which newly formed connective-tissue cells burrow their way from either side, until they form a union across the wound. In this way the primitive exudation serves as a supporting framework for the newly forming tissue. The capillary vessels also bud forth from the adjacent parts, and penetrate into the growing cicatrix. By this proliferation of the cellular elements of the tissue, union is effected, and a *scar* is formed. The original plasma breaks up during this process, and is removed by absorption. It should be noticed, in this connection, that during the healing process, cellular elements always reproduce their like; connective tissues producing new connective tissue, and epithelial cells bringing forth the epithelial investment of the scar.

If early adhesion be not secured, the surface of an open wound gins to granulate, and the cavity heals by granulation. Its surface comes roughened or granular through the protrusion of minute vas- lar tufts that are forced outward by the blood pressure. The heal- g process advances from the margin of the wound toward the centre, ıtil it is completely covered with newly formed epithelium. During is process, a considerable amount of inflammation and suppuration kes place, giving rise to the ordinary phenomena of inflammation that n be observed upon mucous surfaces. The deeper parts of the ound are chiefly occupied by newly formed connective tissue and mph corpuscles. Along the margin of the ulcer into which the origi- l wound is now transformed, the budding epithelial cells gradually ttend toward the centre, until the whole surface is covered. Unless is process of epithelial growth proceeds with due rapidity, the wound ill remain unhealed, rendering it necessary to resort to the operation *skin-grafting*, by transplanting portions of healthy skin to different ints upon the surface of the ulcer, where they become adherent and adually extend their epithelium over the entire surface.

When two granulating surfaces are placed in close apposition, their nion occurs in a manner analogous to healing by first intention. The anulations serve as a support for the actively growing connective- ssue cells, which finally unite across the cavity of the wound, and by eir pressure cause atrophy and subsequent absorption of the granula- ons themselves.

Many of the chronic inflammations that involve the deeper tissues of e body are not attended by suppuration. When *the connective tissues* an organ are thus invaded by the inflammatory process the paren- ymatous structures are subjected to continuous pressure, resulting in eir atrophy and disappearance. Such chronic interstitial inflamma- on is termed *sclerosis*. It occurs in the liver, where it causes con- action and induration of the organ in hepatic cirrhosis. A similar rocess often involves the connective tissue of the spinal cord, consti- ting spinal sclerosis.

But in certain cases, *the parenchymatous structure* of an organ is e principal theatre of the inflammatory process, constituting what is rmed *parenchymatous inflammation*. The tissue cells become infil- ated and enlarged; their function is seriously impaired, and they are able to undergo fatty degeneration and destruction. During the early ages of both interstitial and parenchymatous inflammation the affected ssues are tumefied, causing enlargement of the inflamed organs; but the later stages of the inflammatory process, contraction, compres- on, atrophy, and degeneration combine to diminish the bulk of the flamed tissue.

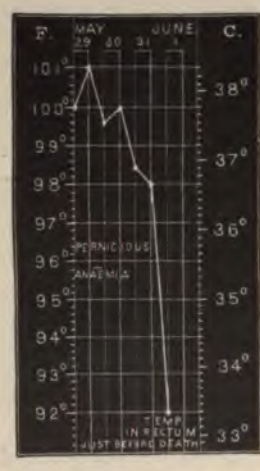
CHAPTER IX.

FEVER.

FEVER is a disordered state of the bodily functions, of which the most prominent symptom is a protracted elevation of temperature above the normal standard. The normal temperature of the body oscillates a little above 98.4° F., being slightly lower in the morning, and moderately increased during the early part of the night; the normal difference between the extremes of morning and evening temperature being about 1.5° F.

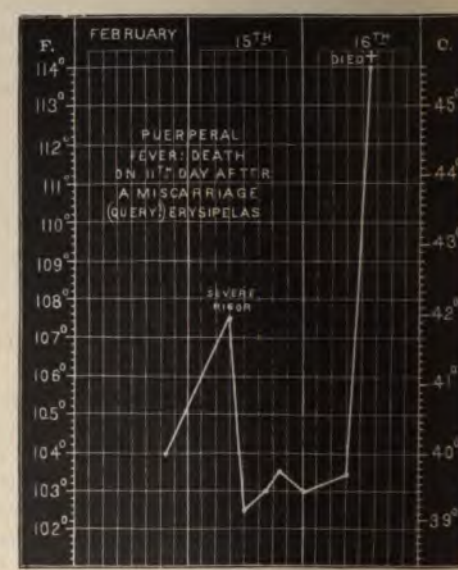
In certain states of disease, as in the collapse of cholera, or as a consequence of poisoning with alcohol, the temperature may be temporarily reduced many degrees below the normal standard. (Fig. 44.)

FIG. 44.



Very low temperature in rectum just before death. (FINLAYSON.)

FIG. 45.

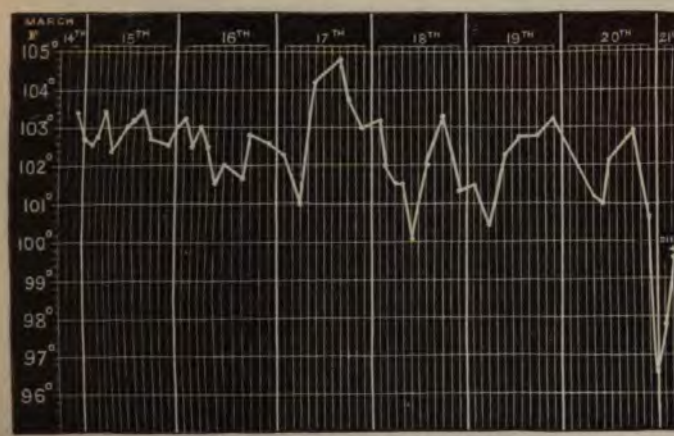


Unusually high temperature just before death; great exacerbation, with a rigor. (FINLAYSON.)

In like manner, under the influence of various diseases the temperature (Fig. 45) may rise many degrees above the normal standard. Temperatures below 95° F. indicate *collapse;* temperatures between 95° and 98° are called *subnormal;* temperatures between 98.4° and 101° constitute *moderate fever;* temperatures between 101° and 105° constitute *severe fever;* above 105° or 106° it is described as *hyperpyrexia*, a condition sometimes observed in dangerous forms of cerebral

sease, infective fevers, or rheumatism. Fevers are said to be *con-nuous* (Fig. 46) when the febrile temperature is constantly above the

Fig. 46.



nperatures in a case of acute miliary tuberculosis in a boy, showing the type of a continued fever. Pulse 130–160; respiration 40 to 60 and 70. (Finlayson.)

rmal standard, with only the usual diurnal variations between morn-g and evening temperature. Fever is said to be *remittent* (Fig. 47) en the diurnal oscillation exceeds the normal variation of 1.5° F. ver is *intermittent* when the decline of temperature reaches the

Fig. 47.



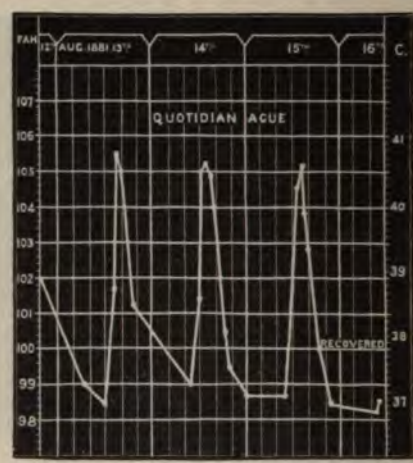
Diurnal variations of temperature in a case of remittent fever.

rmal standard with an interval of apyrexia (Fig. 48) between the roxysms. *Sthenic fever* is a term applied to forms of fever that are aracterized by vigorous reactions. *Asthenic* or *adynamic fevers* are aracterized by depression and languor in all their features.

Hyperpyrexia is a term that is applied to all cases in which the tem-

perature exceeds 106° F. for any considerable time. Such fevers are usually asthenic and rapidly fatal. *Relapsing fever* signifies a return

Fig. 48.



Daily paroxysms in intermittent fever. Quotidian ague; temperature in axilla. (Finlayson.)

of the febrile phenomena after their apparent disappearance (Fig. 49 in particular forms of infective disease.

Fig. 49.

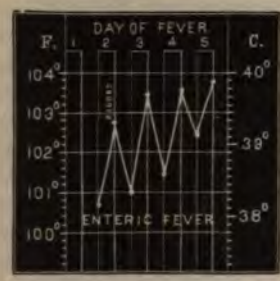


Temperature in relapsing fever. (Wunderlich.)

Symptoms of Fever. One of the most typical forms of fever is fu nished by the paroxysm of intermittent malarial fever. It commenc

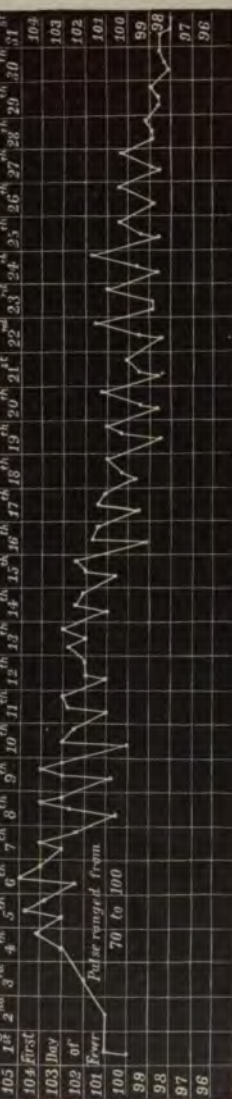
with a sensation of discomfort, great thirst, depression, disposition to yawn and stretch, accompanied by a feeling of chilliness, with distinct rigors, although the temperature of the body is actually rising.

FIG. 50.



Gradual rise of temperature at the beginning of enteric fever. (FINLAYSON.)

FIG. 51.



Temperature in a case of enteric fever. (FINLAYSON.)

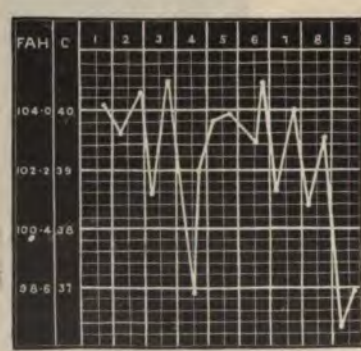
The extremities are cold, the pulse is small and wiry from contraction of the arterial coats. In young children the rigors sometimes reach the severity of a convulsion, which replaces the chill that is experienced by adults.

This *first stage* of the *fever* may occupy one or two hours, in intermittent fever, or it may be prolonged over several days, as in typhoid fever (Fig. 50). When thus prolonged the sensation of chilliness alternates with paroxysms of heat. At the expiration of the period of invasion, the fever passes into a stage of continuous progress called the *fastigium*. This may last a few hours only in intermittent malarial fever, or it may be prolonged for two or three weeks (Fig. 51) in typhoid fever. When thus prolonged the type of fever is continuous. There is constant *elevation of temperature*, the skin feels hot, sometimes dry and burning, sometimes moist and warm, the eyes may be red, the cheeks flushed, the mouth hot and dry, the tongue red, pointed, and covered with fur. The surface of the *tongue* may be either white, yellowish-brown, or dark in color; finally, in severe cases, drying up and becoming converted into mahogany-colored scales that crack open, and are smeared with blood from the mucous membrane of the mouth. The teeth also become covered with a thick brownish paste that dries and hardens, constituting what is called *sordes*. Similar collections derived from the breath may

obstruct the nasal passages, causing the patient to breathe through the mouth, thus adding to the dryness and disorder of that cavity. *Respiration* is usually accelerated as the temperature rises. It may be disturbed by cough in certain complications of disease. The movements of the *heart* become more frequent, and are less vigorous as the rate of the *pulse* rises. In asthenic cases it becomes very frequent, small and feeble. There is loss of *appetite*, frequently nausea and vomiting, more or less complete arrest of digestion, constipation or diarrhœa, and a change in the quantity and quality of all the gastro-intestinal secretions. The *urine* diminishes in quantity, becomes highly colored, its specific gravity increases, and it is often excessively acid. The functions of the *nervous system* are more or less disordered. The *mind* may become clouded; delirium supervenes, and may deepen into sopor, terminating in coma and death. The course of delirium varies according to the temperament, age, and sex of the patient, being more frequent and of less importance in young and nervous subjects than in patients of the opposite type. *Pain* in the form of headache, rachialgia, neuralgia, and a feeling of soreness in the muscles and extremities is usually experienced. In severe cases merging toward a fatal termination, muscular twitching and jerking of the extremities, the so-called *subsultus tendinum*, is often observed. Death may occur in any stage of the fever as a direct result of its cause, or as a consequence of the exhaustion produced by its duration.

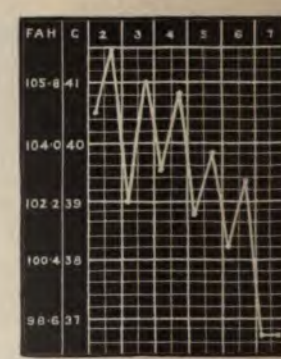
The *third stage of the fever* is the period of *defervescence* and *convalescence*. It is sometimes ushered in by *crisis* (Fig. 52), when the

FIG. 52.



Crisis. Temperature in lobar pneumonia. Sudden crisis on eighth day; pseudo-crisis on fourth day. (WUNDERLICH.)

FIG. 53.



Lysis. Temperature in broncho-pneumonia. Gradual fall extending over four days. (WUNDERLICH.)

fever suddenly leaves the patient, the temperature falls to the normal or below the normal standard, and all the other morbid symptoms exhibit amelioration. Such crises may be witnessed in the decline of pneumonia, typhus fever, relapsing fever, and intermittent fever. It is often accompanied by copious perspiration, diarrhœa, and other critical

discharges. Usually, however, the decline of fever is gradual and may occupy a number of days. This mode of defervescence is called *lysis*. (Fig. 53.) It is the form of decline that is witnessed in typhoid fever.

Etiology of Fever. Fever may be caused by simple irritation of the nervous system, as in certain cases of hysteria in which delicate and nervous patients exhibit a febrile reaction, usually of brief duration, as a consequence of almost any excitation of their nerves. Such fevers are called *neurotic* or *transient fevers*. Among the most common consequences of inflammation is a fever which is apparently due to an infection of the nervous centres with certain products of inflammation that find their way into the general circulation of the body. Such fevers are called *inflammatory*.

If the blood be contaminated by the introduction of septic materials or the products of putrefaction, a violent febrile reaction ensues. Invasion of the body by certain microörganisms, and contamination of the blood by their excreta, will produce fever. In this way the so-called *infective fevers* are produced.

Pathology of Fever. The heat of the body is maintained by the oxidation of its tissues. It is probable that in a simple organism mere increase of oxidation would be sufficient to produce the phenomena of fever, but in a large and complicated structure, like the animal body, the febrile movement is a more complex process. Increase of temperature may be caused by increased oxidation and liberation of heat within the body; by diminished dissipation of heat from the body; by the coëxistence of both conditions; or by diminished dissipation of heat coëxistent with reduced production.

These varying conditions depend upon the regulative influence exerted by the nervous centres over the processes of heat-production, distribution, and dissipation. It has been shown by experiment that in and adjacent to the corpus striatum are located nervous centres that govern these processes.

Excitation of these centres through the medium of the cerebrum itself may produce disturbances of temperature, as in hysterical fever. *Derangement* of the functional activity of these and other nervous centres by contamination of the blood with the products of inflammation may also disturb the temperature, and produce the phenomena of inflammatory fever. And, going still further, the action of blood that has been contaminated with the *excreta of various microörganisms* may give rise to the phenomena of specific infective fevers.

Results of Fever. Great importance has been attached to the effects of a prolonged temperature upon the nutrition of the tissues. Cloudy swelling and fatty degeneration of the elements of the tissues are frequently observed; the voluntary muscles undergo colloid degeneration in many of the infective fevers. Muscles thus affected exhibit within the sarcolemma irregular masses of a hyaline substance derived from a degenerative transformation of the muscle fibre.

The Prognosis in fever depends upon the severity of the symptoms and upon their duration. General increase and continuous elevation of temperature is of more serious import than a remittent or inter-

mittent course. If the evening temperature does not rise above 104° or 105° F., the prospect of recovery is favorable, but temperatures that exceed those figures for any length of time indicate the probability of a fatal termination. Asthenic conditions, marked by a rapid and feeble pulse, even though the temperature be not excessive, indicate a state of danger. High temperature of the body associated with coldness of the extremities is an unfavorable indication. Nor is the process of defervescence without its attendant perils. Crisis may become merged in fatal collapse, as may be sometimes observed in the defervescence of pneumonia. A medium temperature, the preservation of a fair degree of secretory and digestive power, a moderate and unwavering pulse, the absence of serious derangements of the nervous system, and the non-existence of complicating diseases, furnish the most reliable basis for a favorable prognosis.

TREATMENT. The principal indication for treatment in fever is to assist the organs whose function has been deranged by the cause of the disease. For this purpose it is necessary to have regard for the general management of the patient. Perfect cleanliness of the whole body and of its surroundings is of importance. The most perfect ventilation of the apartment in which the patient lies must be secured. Rest and quiet, and skilful nursing, with proper diet, are indispensable.

The elevation of temperature that marks the course of fever is not an unmixed evil, yet it is customary to attempt its reduction. The most efficient means for the reduction of temperature is found in the application of cold water to the suface of the body. By this method, heat is rapidly abstracted from the body; and the local effect of cold water upon the cutaneous nerves exercises a beneficial effect upon the central nervous system, and upon the organs under its influence. Cold water may be applied by sponging the surface of the body with tepid water, or with water that is actually cold, if the patient does not shrink from such an application. Cold compresses or rubber bags containing cold water may be applied to the chest and abdomen. Ice-bags may be in like manner applied to the head, and cold water may be made to circulate through coils of tubing adapted to the body; but the most effectual method consists in the use of the cold bath. The patient should be placed in a tub containing water at the temperature of 90° F., which may then be cooled down to 65° or 60° F. If the patient begins to shiver, he should be immediately removed, rubbed dry, and placed again in bed. In this way the temperature may be reduced several degrees; and the bath must be repeated as often as it again rises to an excessive figure. Almost as efficient, and often more convenient, is the employment of the cold wet pack.

The use of medicinal agents is of service, not only in the reduction of temperature, but as a contribution to the comfort of the patient. Quinine, in doses of fifteen grains, has a powerfully depressing effect upon temperature; it is especially useful in malarial fevers. Salicylic acid and its compounds are almost equally specific in the treatment of rheumatic fevers. Inflammatory fevers are favorably influenced by aconite, veratrum viride, and gelsemium; and in inflammations of the

respiratory organs tartar emetic is also useful. Antipyrine, phenacetine, acetanilide, and exalgine are useful as general antipyretic agents. The efficiency of many of these agents, such as quinine, aconite, and tartar emetic, is considerably increased by the concurrent administration of opiates. Diaphoretics, like Dover's powder, sweet spirits of nitre, and the liquor ammonii acetatis are often serviceable for the relaxation of the skin and the promotion of gentle perspiration. Opiates are especially indicated for the relief of pain, and in small doses they prevent the fretful irritability that is so exhausting to a feeble patient. In like manner various saline solutions, such as citrate of potassium, citrate of lithia, and other effervescing draughts are refrigerant, but their use should be discontinued whenever they become disagreeable to the patient. Purgatives are most valuable at the outset of the fever. It is often well to preface all treatment with several half-grain doses of calomel followed by a saline cathartic, like a Seidlitz powder, Rochelle or Epsom salts, or the various laxative mineral waters.

Solid food should be forbidden, and the diet should consist of liquid preparations. Cold water may be allowed. Milk is the model article of diet, but should never be given beyond the power of the digestive organs to accomplish its digestion. Frequent examination of the stools is therefore necessary to ascertain the efficiency of the digestive function. Beef-tea, animal broths, gruels, peptonized foods, eggs, and raw oysters may often be used with advantage. During the course of long-continued fevers the amount of food must be increased beyond what is needed in the early stages of the disease.

Alcoholic stimulants are not as necessary during the course of fevers as was formerly supposed. Only in long-continued and asthenic cases is alcohol needed. It should be administered in small quantities, at regular intervals, and the quantity given should rarely exceed six or eight ounces of whiskey or brandy in the course of twenty-four hours. The breath of the patient should never become saturated with alcohol, and its administration should be checked whenever the odor of alcohol is noticeable in the breath. Dryness of the tongue, increased heat, greater rapidity of the pulse and respiration, accompanied by low muttering delirium, nausea, and vomiting, indicate an excessive alcoholic stimulation. Diminished intensity of fever is the only indication of benefit from alcoholic stimulants.

Particular symptoms of fever sometimes require special attention. Severe headache may be relieved by cold applications to the head. For elderly patients, or those who are extremely feeble, warm affusions are often preferable. Inflammatory fever with head symptoms may require the application of leeches to the temples, or cups between the shoulders, followed by blisters in the later stages of the fever. Active delirium is an indication for sedatives and hypnotics, while low muttering delirium is an indication for the cautious use of stimulants and opiates, especially in the delirium of old people unattended by pulmonary obstruction. If sleep is not procured by the use of cold applications and the ordinary antipyretic measures, it must be obtained by the use of hypnotics. In sthenic cases ten grains of Dover's powder

are often sufficient, or a twelfth of a grain of tartar emetic added to a grain of opium, or to a quarter of a grain of morphine, will be found useful. Five drops of the tincture of aconite with a quarter of a grain of morphine forms an excellent substitute for the foregoing preparations. In asthenic cases, camphor should be combined with an opiate, as in the opium and camphor pill; but in all cases of interference with respiration, opiates should be administered with great caution. Hydrate of chloral, sulphonal, paraldehyde, the bromides, tincture of hyoscyamus, tincture of belladonna, cannabis indica, and various compounds of these drugs, are found useful.

The restless wakefulness of low fevers must be combated by the administration of food such as milk, egg-nogs, brandy and egg, with opiates and stimulants. Carbonate of ammonia, sulphuric ether, aromatic spirits of ammonia, camphor, capsicum, musk, caffeine, and nux vomica must be used in failure of the heart. Food and stimulants, if not retained by the stomach, can be given by injections into the bowels. The bladder should be carefully emptied with a catheter, if necessary. Bedsores must be prevented by cleanliness, proper bedding, and the employment of a water-bed in severe cases. Convalescence from fever requires great care in the matter of diet and fatigue. Restorative remedies and tonics must be furnished with a liberal hand. A change of locality is often attended with the best of results.

PART II.

PARASITIC AND INFECTIVE DISEASES.

DISEASES CAUSED BY ANIMAL PARASITES.

CHAPTER I.

INTESTINAL WORMS.

Diseases affecting the surface of the body should first engage the attention of the student. These are fully described in the standard works on dermatology. It will be found that a considerable number are caused by the action of animal and vegetable parasites upon the cutaneous investment of the body, but the action of parasites is not limited to its external surface; the alimentary canal may become infested by parasites of animal and vegetable origin. The vegetable parasites will be considered in the portion of this work that treats of the infective diseases.

Nematoid Worms.

Lumbricoid Worms. (Ascaris Lumbricoides.)

Description. These worms inhabit the small intestines. They resemble in size and shape the common earth-worm. (Fig. 54.) The male is about nine or ten inches long; the female, from eighteen to nineteen inches in length. They are of a pink color; the mouth has three rounded lips. The posterior extremity of the male is curved and furnished with two sexual prominences. The genital opening of the male is near the middle of the body; the eggs, which are estimated at about sixty millions in number, are round. It has been thought that these eggs must undergo development outside of the human body, but later investigations indicate that such development is unnecessary, that they only need introduction into the alimentary canal, where they readily germinate. Discharged from the bowels with the fecal evacuations, they preserve their vitality for an indefinite length of time, and probably find their way back into the human intestine through the medium of drinking-water. It has been observed that they are more frequently encountered in persons who do not drink filtered water. They are

most frequently found in the intestines of children, and are sometimes discovered in the biliary passages, and in other ducts that communicate with the alimentary canal. Thus they may find their way into the stomach, œsophagus, the nasal passages, the larynx, the Eustachian tube, and even into the lachrymal canal, and the cavities behind the face. Ordinarily but one or two worms occur, but sometimes they are voided in large numbers, or may even obstruct the intestine by their accumulation. Abscesses and tumors connecting with the intestines sometimes contain these parasites, and they have thus gained access even to the urinary passages.

FIG. 54.



B. Egg of ascaris lumbricoides. × 250. (BRISTOWE.)



A. Ascaris lumbricoides. (Nat. size.)

SYMPTOMS. Lumbricoid worms frequently exist in the intestines without producing any morbid symptoms, but sometimes their presence excites various disturbances of the nervous system, principally involving the digestive functions, giving origin to salivation, itching of the nose, diarrhœa, dyspepsia, palpitation of the heart, cough, vertigo, and various other anomalous cerebral disturbances. Epileptiform and hysterical convulsions have been observed. These various disturbances appear to be produced by nervous irritation occasioned by the excretions of the worm, rather than by their mere presence in the alimentary canal.

TREATMENT. The bowels should be evacuated with castor oil, and, for a day previous to the administration of the vermifuge, the patient should be restricted to a scanty liquid diet. Santonin is the most successful agent for the expulsion of the parasite. It may be given in doses of one to five grains every morning until the worms are expelled, and their ova no longer appear in the feces. It may be sprinkled upon a bit of bread and covered with butter, when it can be given without difficulty to the youngest child. Older patients can take it in the form of pills, or mixed with small doses of castor oil, which is said to increase its efficiency. Care must be taken to avoid excessive doses, as the drug sometimes causes vertigo and other disagreeable nervous symptoms. Unnecessary alarm may be avoided by informing the parents or friends of the patient that the urine will become yellow under its influence, and, if voided into a vessel that contains any alkali, will exhibit a bright pink or scarlet color.

Oxyuris Vermicularis.

Description. A minute round, white, thread-like worm. (Fig. 55.) The male is about one-sixth of an inch long; its posterior extremity lies in a coil and contains the sexual organs. The female is nearly half an inch long; the rounded anterior extremity contains the mouth with three lips; the sexual orifice is near the junction of the anterior and middle thirds. The posterior extremity is very thin and pointed. The eggs are exceedingly numerous, flat on one side and rounded on the other. They do not mature until they have been expelled from the intestine and have found their way into the stomach of another individual. Desiccation does not destroy their vitality. They develop in the small intestine, where the union of the sexes takes place. The males then die and are eliminated with the fæces, while the females pass onward into the cæcum, where their eggs are matured. They then pass downward into the rectum, from which they frequently find their way out into the vagina or even into the urethra and bladder. At night they often make their appearance upon the cutaneous surfaces around the anal orifice. The principal inconvenience caused by their presence is an intense itching of the parts about the anus. Their presence may cause an inflammation of the rectal mucous membrane, and in excitable patients various nervous disturbances are sometimes observed.

Fig. 55.



Thread-worm. *a*. Female. *b*. Male. × 10. *c*. Actual length of female. *d* Egg. × 250. (Bristowe.)

Treatment. Perfect cleanliness about the anal orifice must be secured. The rectum and large intestine should be washed out every day with a copious injection consisting of common salt, or any other alkaline salt, dissolved in tepid water. After the bowels have been thus evacuated, the rectum should be filled by injection with some bitter infusion, like quassia, wormwood, or boneset. Injections of glycerin and water, in equal parts, are useful. Santonin may be given internally, and anal irritation may be relieved by the nightly application of mercurial ointment, which may also be introduced into the rectum.

Filaria. Filaria Medinensis, or Guinea-worm.

Description. In warm climates a species of filaria, or hair-worm, remarkable for its length, which varies from fifteen to thirty-five or forty inches, is sometimes found under the skin of the legs and feet, sometimes in the scrotum or on the body, and occasionally in the superior extremities. Its presence gives origin to tumors of an elongated and cord-like shape, which present an appearance of inflammation. After a time they open and discharge a serous liquid. The hair-like worm can then be discovered in the cavity, and can be extracted by

careful manipulation. It has been thought that it enters the areolar tissues by perforation of the skin, but other observers believe that it finds its way with drinking-water into the stomach, from which it penetrates the tissues.

Filaria Sanguinis Hominis.

Description. The full-grown filaria is about four inches long, and has a very slender neck and rounded head. (Fig. 56.) It is especially

Fig. 56.



A. Filaria sanguinis hominis. × 250. (After Lewis.)



B. *a*. Female filar (Nat. size.) *b*. Ovu × 250. (Cobbold.

in the lymphatic system that it is found, but its embryos may be also discovered in the blood during the hours of the night. During the day it cannot be found in the blood, unless the patient sleeps in the daytime and wakes at night. These embryos are about one-third of a millimetre in length. The head is rounded; the posterior extremity slender and pointed. This larval creature is surrounded by a thin sheath in which it moves freely. When circulating in the blood, the embryonic parasites may be absorbed into the body of the mosquito, where they undergo further development. The sheath of the embryo is dissolved, and at the end of a few hours the filaria has increased its length threefold. The mouth and alimentary canal become fully developed, sexual organs appear, and the worm is ready for life in the water which receives the dead body of its host. If now suc water be used for drinking purposes, the parasite enters the alimentar canal of man, and once more finds its way into the circulatory channe of the body. Multiplying in the bloodvessels and in the lymphat canals it produces great distention of the lymphatics, giving rise elephantiasis of the scrotum, hæmaturia, chyluria, and various lymp atic tumors. Other species of filaria have been discovered among th inhabitants of the tropics, especially in Africa.

Trichina.

al state this parasite is found in the muscles of swine and . Flesh thus infected, if taken into the stomach of man, embryos into the alimentary canal, where they develop. e about three millimetres in length, while the females are as long. Fecundation and development having taken intestines, the parent worms die, ffspring in the embryonic stage intestinal walls, and find their muscles throughout the body, ay be discovered about fourteen ie introduction of the encysted the stomach. Having reached the little worms coil themselves muscular fibres, and surround th an envelope (Fig. 57), formed connective tissue, and lined with similar to chitine. Within this m lies in a spiral coil. At the three to six months these cysts ated with calcareous salts, giving e of minute white granules scat- the muscles. In this condition retain their vitality for a number if the mass of flesh in which they find its way by any chance into f another animal, they are speed- by the solution of their envelopes cycle of change. The liberation the intestine produces an inflam- mucous surface, causing abdominal pain, diarrhœa, and miting, with loss of appetite, and the phenomena of A few days later, the limbs become painful, the mus- nd are sometimes contracted, the face and whole body tly œdematous, the abdomen swells, the tongue dries, us perspiration; dyspnœa and a sensation of constriction rax are experienced. The patient falls into a typhoid n mistaken for typhoid fever. As the parasites become fever subsides, but diarrhœa may persist, the lungs become ie whole body grows dropsical and pallid; sometimes bed- id the patient may die at the end of one or two months. wever, takes place in the majority of instances. About f the cases are fatal.

Fig. 57.



Trichina spiralis Encysted trichina. × 100. (Bristowe.)

CAL ANATOMY. Very little can be discovered after death, presence of the parasites in the muscles. When diarrhœa death, the evidences of inflammation may be discovered in stine, and the liver may have undergone fatty degeneration. not affected. The lungs frequently present evidence of

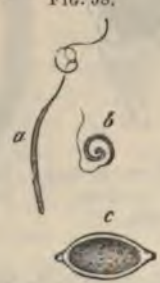
localized pneumonia. The parasites are most numerous near the tendinous extremities of the muscles, and are most frequently found in the muscles adjacent to the alimentary canal. The muscular fibres present a granular appearance. Sometimes there is waxy degeneration; and the amount of connective tissue is considerably increased in the neighborhood of the parasitic cysts.

TREATMENT. Thorough cooking destroys the vitality of the encysted parasites. It is the use of raw or partially cooked pork that is most dangerous. Such meat should never be consumed without previous inspection with the microscope, or the most thorough cooking. If trichinosis be suspected, the alimentary canal should be thoroughly evacuated with calomel and jalap, or with castor oil. After invasion of the muscles has taken place, there is no specific remedy for the disease, and each case must be treated on general principles, with anodynes for the relief of pain, warm baths, gentle friction of the surface, and attention to every complication that may arise.

TRICHOCEPHALUS DISPAR.

This parasite is sometimes found in considerable number in the small intestine, and especially in the cæcum. It is nearly two inches in length. The anterior three-fifths of the worm forms an exceedingly delicate and hair-like tube containing only the œsophagus. (Fig. 58.) The posterior portion is very much thicker, contains the principal organs of the body, and, in the male, is coiled in a flattened spiral. It has been supposed to originate various nervous disturbances, and even inflammation of the cæcum, but nothing very definite is known regarding the matter. The eggs of the parasite are taken into the stomach with drinking-water. They are oval in shape, and present a minute prominence at each extremity, by which they may be easily recognized with the miscroscope. In about a month, the embryos are developed, and have reached maturity. The symptoms are generally negative, and the treatment is the same that is recommended for the expulsion of oxyuris.

FIG. 58.



Trichocephalus dispar. *a*. Female. *b*. Male. (Nat. size.) *c*. Egg. × 250. (BRISTOWE.)

ANCHYLOSTOMUM DUODENALE (*Dochmius Duodenalis*).

This parasite is from six to eighteen millimetres long. The females are about twice as large as the males. (Fig. 59.) The mouth is furnished with four teeth upon the ventral margin, and two upon the dorsal. With the aid of this apparatus, it attaches itself firmly to the mucous surface of the small intestine, where its continual suction deprives the patient of blood, and frequently occasions intestinal hemorrhage. Digestion suffers, and profound anæmia ensues. The eggs are evacuated with the feces, and mature in water outside of the body.

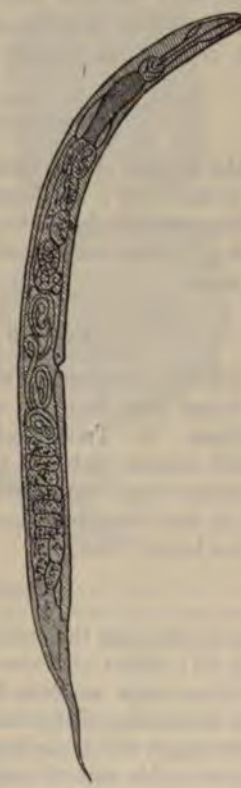
Infection is caused by drinking water that contains the eggs of larvæ. In Egypt, in Italy, and in Central Europe, these parasites have been discovered among brick-makers, coal-miners, and workmen who have been compelled to drink impure water. It has been ascertained that the intense anæmia common among such workmen is due to infection with these parasites. The workmen employed in the construction of

FIG. 59.



Anchylostoma duodenale. *a*. Female. *b*. Male. × 10. *c*. Actual length. (BRISTOWE.)

FIG. 60.



Anguillula stercoralis. Female with eggs and embryo. × 85. (PERRONCITO.)

the St. Gothard tunnel furnished many examples of this disease, which may be readily detected by examination of the feces and discovery of the ova with the aid of the microscope.

TREATMENT should consist in the administration of mercurial cathartics, followed by santonin until the ova can be no longer detected in the evacuations. The parasitical anæmia may be relieved by the exhibition of iron, arsenic, and tonics.

Anguillula Intestinalis and Anguillula Stercoralis.

These minute, eel-shaped parasites, one or two millimetres in length, exist in great numbers in the duodenum and jejunum of certain inhabitants of the tropical regions of the world. In Cochin-China, the West Indies, South America, and even in Italy, their presence has been determined, and it is generally supposed to be the cause of an obstinate form of diarrhœa. (Fig. 60.) So rapidly do the parasites multiply in the intestine, that patients have been known to evacuate more than a hundred thousand of these creatures in a single day. A long continued diet of milk constitutes the most effectual means of cure.

Strongylus Gigas.

This is the largest of the nematoid worms. The male is from six to seventeen inches long; the female is from seventeen to forty inches in length. Most commonly found in the kidney and bladder of the horse, cow, and dog, it has occasionally been observed in the corresponding organs of man.

Cestoid or Tapeworms.

Many different species of tapeworm have been described, but the principal forms are four in number: 1. Tænia solium. 2. Tænia mediocanellata. 3. Tænia echinococcus. 4. Bothriocephalus latus. The different species of tænia may exist in the human body under two different states—the cystic and the vermiform. Of these, the last is developed in the intestinal canal, while the first may be found in any organ of the body.

Tænia Solium.

This worm occupies the small intestine. Its head is octohedral in shape (Fig. 61), about the size of a small pin-head, furnished at the sides with four large suckers, by the aid of which it attaches itself to the mucous membrane of the intestine. Anterior to these is the *rostrum*, a contractile organ which can be protruded or retracted at will. It is surrounded by a double row of hooklets, from twelve to fifteen in each row, of which each one closely resembles in shape the claw of a cat. These accompany the movements of the rostrum. The neck is about an inch in length, transversely marked, and exceedingly slender. Behind this are developed the separate segments of the animal. These segments or *proglottides* are protruded from the neck, one after another, the oldest being largest and most distant from the head. Each segment consists of a whitish, translucent flattened mass, provided with contractile tissues, a water-vascular system for the circulation of liquids, and a reproductive apparatus that represents the organs of both sexes. The segments are closely linked together in such a way that their vascular canals communicate with each other. Each link or segment contains a complete and independent reproductive apparatus, provided with male and female organs. The ovaries occupy the greater portion of the

segment, with seven or eight lateral branches communicating with a central canal or uterus which opens upon one of the margins about the middle of the segment. These marginal orifices are placed alternately upon opposite sides of the successive segments. Thus constituted, the length of the worm may reach several feet, lying coiled in the small intestine. Single segments and considerable sections of the worm may become detached, passing with the feces through the large intestine.

Fig. 61.



Tænia solium and cysticercus. *a*, *b*, *c*, *d*. Different parts of tapeworm. (Natural size.) *e*, *f*. Cysticercus cellulosæ. (Natural size.) *g*. Head. *h*. Head seen from above. × about 50. *i*. Sucker. × 250. *j*. Hooklet attached. × 250. *k*. Egg. × 250. (Bristowe.)

The eggs, voided in great numbers, find their way into the water of the earth, and may thus be introduced into the stomach with unfiltered drinking-water. There they are digested, and the embryonic worms are set free. Thus liberated, the embryo consists of a minute vesicle called the *proscolex*. Upon one side of this little sac appear three pairs of spiculæ, the rudiments of the crown that surrounds the rostrum of the mature animal. Penetrating the walls of the stomach or intestine, the embryo migrates to other parts of the body. There it becomes fixed and develops the larval form. The head assumes a shape like that of the parent worm, and is inverted within the cyst-like body. In this condition the parasite is called a *scolex*. It becomes surrounded by a connective-tissue sac, and remains imbedded in the flesh or organs of the animal, where its presence may be discerned by the naked eye, giving to the muscular tissue a speckled appearance known as measles.

After remaining for a year or more in the living animal, the scolex dies, becomes infiltrated with calcareous matter, and shrinks almost out of sight. These scolices were formerly supposed to be distinct para-

sites, to which was given the name of *cysticercus cellulosæ*. The cysticerci have been found in every part of the body, and have been observed in the eye. They vary in bulk from the size of a mustard-seed to that of a small pea. In the brain they may originate circumscribed inflammations which sometimes result in the formation of abscesses, producing epileptiform convulsions and various forms of cerebral paralysis.

If, now, the flesh of an animal containing these larval parasites be eaten raw or partly cooked, the scolices are liberated in the stomach. Having reached the small intestine, the head is protruded from the larval sac and becomes attached by its suckers to the intestinal wall. The sac disappears, and the worm grows by the budding of segments in succession from its neck. In a few months the well-known form and size of the mature worm are reached. The life of the animal in this situation may be indefinitely prolonged, ripened segments and ova being continually separated and discharged from the intestine.

SYMPTOMS. Once developed in the small intestine, the tapeworm may exist in the alimentary canal for a long period of time without the occurrence of any symptoms denoting its presence, excepting the appearance of its segments and ova in the feces. Sometimes, however, the ordinary symptoms of chronic catarrhal enteritis are present. The general symptoms of nervous irritation, such as cardiac disturbances, muscular twitching, uneasy sensations in the head, thorax, and abdomen, and even epileptiform convulsions, have been noticed.

TREATMENT. Since the larvæ of tænia solium are, for the most part, derived from measly pork, the avoidance of such food is imperatively demanded; and animals, like hogs, that are raised for human consumption, should not be allowed access to food or water that may be contaminated with fecal substances.

When the worm has found lodgment in the intestine, treatment should not be undertaken until the presence of the parasite has been demonstrated by the appearance of its segments in the excrements. The indications for treatment are destruction of the life of the worm, and its removal from the bowels. A variety of drugs have been recommended for this purpose. For two or three days before the administration of tæniacide drugs, the diet should be restricted to milk and bread, and a dose of castor oil or of compound licorice powder may be given the day before the commencement of specific treatment. Having thus prepared the patient, the selected drug may be given in the morning while the patient is yet fasting; and in a few hours, if the worm is not discharged, another cathartic dose of castor oil may be given. The favorite remedy is the ethereal extract of the root of male fern. This may be given in doses of half a drachm, or a drachm, repeated twice at intervals of half an hour. It may be suspended in milk, or may be given in gelatin capsules, as otherwise it is likely to prove nauseating. The evacuated worm should be received in a vessel of water, in which it can be washed and carefully examined for the discovery of the head; for if that portion of the worm remain attached to the intestinal wall the body of the animal will be rapidly reproduced. If the head does not appear with the remainder of the worm, the cure must remain doubtful for three months or more, until sufficient time has elapsed for

the reappearance of ripened segments in the feces. Treatment should not be resumed before that time.

Oil of turpentine to the amount of one or two fluidounces, made into an emulsion, is sometimes employed with success. A decoction of the fresh bark of the pomegranate root, prepared by infusing three or four ounces of the bark for twelve hours in a pint of water, and then reducing the amount one-half by evaporation over a slow fire, may be given in divided doses during the course of an hour, and may be followed by castor oil. The only objectionable feature of its administration is the liability to nausea, which may be avoided by giving the liquid in small and frequent doses.

Tannate of pelletierine, an alkaloidal derivative of the pomegranate root, is a most effectual but rather expensive remedy for tapeworm. The dose is from seven to twelve grains, to be followed by castor oil.

Kousso, and its alcoholic derivative koussine, have been used extensively in the Orient. Pumpkin seeds furnish an oil which may be used in doses of half an ounce or an ounce. The perisperm, or meats, extracted from four ounces of the fresh seeds and rubbed in a mortar into a paste with sugar and milk, will be found useful, forming a not disagreeable preparation which may be taken in divided doses, at short intervals, to the amount of a pint. This remedy possesses the advantage of easy preparation and no violent or disagreeable action.

Tænia Mediocanellata.

In the larval state, this parasite inhabits the flesh of the ox. (Fig. 62.) The ova are swallowed by the animal with its food or drink; the embryos are liberated in the stomach and intestines, whence they penetrate into the muscles, where they remain as *scolices* or *cysticerci*. In the mature condition the worm inhabits the small intestine of man, like the tænia solium similarly derived from measly pork. The head of the worm has no rostrum and is destitute of hooklets, but attaches itself by suckers to the mucous membrane. The worm grows by the devolopment of segments precisely like tænia solium. The vascular apparatus is also similar, but the ovaries in each segment are much more branched, and their external orifice is placed irregularly alternately upon opposite margins of the successive segments. The full-grown worm may be developed in the course of fifty or sixty days, and may reach a length exceeding that of the entire intestinal canal. The ripened segments are discharged with the feces, or not unfrequently escape alone through the anus, a peculiarity

Fig. 62.



Tænia mediocanellata. *a*, *b*, *c*. Different parts of tapeworm. (Natural size.) *d*. Head. × 10. *e*. Egg. × 250. (Bristowe.)

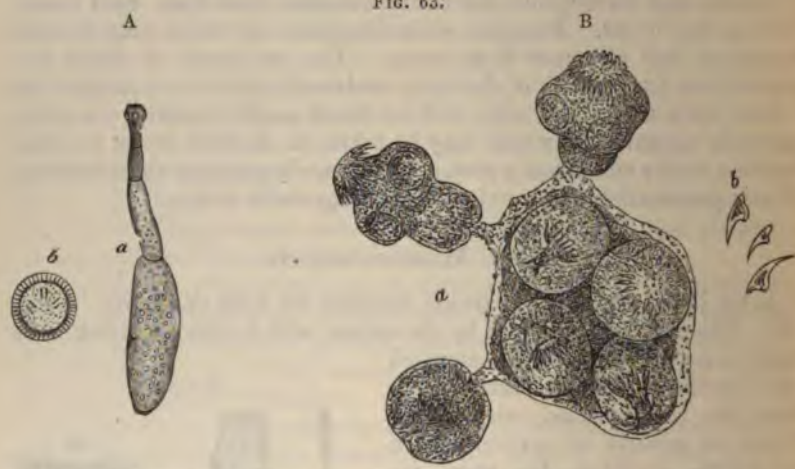
by which this species of worm is characterized. Among beef-eating people, especially among those who are partial to underdone meat, this is the most common form of tapeworm. Delicate children who have been fed upon scraped raw beef are not unfrequently thus infected.

TREATMENT. The symptoms and treatment of this species of tapeworm are identical with what has been already described in the preceding section.

TÆNIA ECHINOCOCCUS.

This species of tapeworm may be frequently seen attached to the *valvulæ conniventes* in the small intestine of the dog. (Fig. 63.) It consists of only four segments, and is a quarter of an inch in length. Like tænia solium, its head is provided with four suckers, a rostrum,

FIG. 63.



A. Tænia echinococcus. *a* Tænia. × 10. *b*. Ovum. × 250.

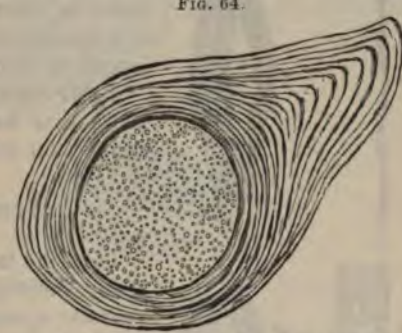
B. Echinococci. *a*. Group of echinococci still attached to ruptured brood-capsule. × 100. *b*. Hooklets. × 250. (BRISTOWE.)

and a double circle of hooklets forty or fifty in number. The terminal segment contains the ova, and when detached is immediately replaced by another. The ova pass from the body with the feces, and may easily find entrance into the stomachs of people who associate freely with dogs. The liberated embryo passes from the stomach into the intestines, and thus finds its way into the tissues of the body. There becoming encysted, it is transformed into the hydatid cyst. These may vary in size from that of a small pea to the dimensions of a large orange.

The *hydatid cyst* is composed of a thick, laminated, translucent, and highly elastic membrane, the *ectocyst*. (Fig. 64.) This is provided with a thin cellular lining called the *endocyst*. Upon the surface of the endocyst are developed numerous little processes which soon present a rounded cavity, lined by a delicate membrane. These constitute the proligerous vesicles. The original sac is called the parent cyst, the secondary processes are called daughter cysts, within which may be

developed a tertiary growth of granddaughter cysts. From the lining membrane of the daughter cysts grow the larval scolices of the future worms. These resemble in structure the head of the mature tænia. So long as the hydatid cyst remains alive, the embryo scolices remain attached to the germinal membrane, but after the death of the cyst they become detached and float free in the liquid contents of the daughter vesicles. Such hydatids are most frequently found in the liver, but they also exist in the muscles, in the bones, in the central nervous organs, and in the subcutaneous areolar tissue. Such hydatid tumors always cause great disturbances of the health, and may occasion the death of their host. The symptoms that are caused by their development in the central organs of the body are those that result from mechanical interference with the functions of the affected organs, and from the atrophy that follows compression through enlargement of the tumor.

Fig. 64.



Hydatid cyst. × 100. (Bristowe)

If the brain be invaded, the symptoms are identical with those that follow the development of other tumors in that organ. Upon the surface of the liver, a hydatid tumor may sometimes be recognized by its globular form, by its elasticity, and by the peculiar thrill imparted to the hand, if the tumor be rapidly percussed. Such tumors occasionally suppurate, and their contents may be discharged like those of an ordinary abscess. The discovery of the characteristic hooklets of the parasite would suffice to identify the disease.

Treatment. Medical treatment seems to accomplish little or nothing against hydatid disease. The only opportunity for relief must be sought through the methods of surgery, when the tumor occupies an accessible cavity.

Bothriocephalus Latus.

Bothriocephalus is the largest of the tapeworms (Fig. 65), sometimes reaching fifty feet in length. Its head is oval, without hooklets or rostrum, and has on each side a longitudinal slit that replaces the suckers of the tæniæ. The neck is long and slender, transversely striated, and gives origin to the segments of the body, which succeed one another as in tænia. The breadth of these segments is greater than their length. The genital orifices are placed near the middle of the ventral surface instead of upon the margins. The male orifice is separate from the female, and is placed a little nearer the anterior extremity of the segment. The uterus occupies the centre of the mass, and consists of an extremely contorted tube. The eggs, oval in shape, opening at one extremity by a lid-like valve, are developed in fresh water. Consumed by fish, they hatch in the alimentary canal, liberating an embryo covered with vibratile ciliæ, and furnished with six

hooklets. This embryo finds its way into the muscles or other where it passes into the larval stage. The flesh of fish containin scolices conveys the embryonic parasite into the stomach of man the larva is liberated, and in the intestine is developed into the worm. It is consequently among fish-eating inhabitants of c adjacent to the ocean that this parasite often encountered. Several other spe bothriocephalus have been occasionally tered in different localities, and in Japa is a species of which the larval form re length of about twelve inches.

FIG. 65.



Bothriocephalus latus. *a*, *b*. Different parts of tapeworm. *c*. Head. × 10. *d*. Egg. × 250. (BRISTOWE.)

SYMPTOMS and TREATMENT correspo those that have been already recommer connection with tænia solium.

Trematodes or Fluke-worms.

Like the tapeworms, these parasites a erally hermaphrodite. They possess a vascular system opening by a single orifi the posterior extremity of the body, whi sists of but a single segment. There is mentary canal opening by a single orific anterior portion of the body. There is sucker at the anterior extremity, and near the middle of the ventral aspect. worm is propagated by eggs, which hat side of the animal and liberate a ciliated that swims freely in water. These penetrate the bodies of fresh-water s which they are transformed into larvæ called *sporocysts*. These cysts contain bud-like processes which develop into another form *redia*. In this form the embryo reaches the liver, where it un further development, producing within itself new forms that, i respects, resemble the parent worm. Having reached this s development, the parasite finds its way from the tissues of the sn the water, where after a time it attaches itself to the adjacen and grass, and passes into an encysted condition. Taken wi into the stomach of graminivorous animals, the embryo finally the liver of its host, where it is developed into the mature fluk

DISTOMA HEPATICUM.

This is the common liver-fluke found in the sheep and i domestic animals (Fig. 66) inhabiting the liver and bile-duc branches of the portal vein, from which it sometimes finds its w other cavities and into subcutaneous abscesses. Only rarely has found in man. It is a flat, tongue-shaped creature, about one in and half an inch wide. Its external surface is covered with scale-like processes. In sheep it is the cause of a disease known

rot. In the human subject it produces an inordinate appetite and a sensation of fulness in the epigastrium. The liver and spleen become enlarged, there is a sanguinolent diarrhœa, the patient becomes dropsical and dies.

FIG. 66.



a. Distoma hepaticum. × 2.5. b. Eggs of distoma hepaticum. × 200. (LEUCKART.)

The diagnosis may be confirmed by an examination of the stools, which contain the eggs of the parasite. Several other species of *distoma* have been noted in different parts of the world, as in the island of Formosa, where nearly one-sixth of the population are infected by *distoma Ringeri*, which develops in the branches of the pulmonary artery and produces dangerous hæmoptysis.

DISTOMA HÆMATOBIUM, OR BILHARZIA.

This species is very common in Arabia, in Egypt, and in other parts of Africa. (Fig. 67.) It inhabits the bloodvessels, especially those of the liver and kidneys, in which it feeds upon the blood. The sexes

FIG. 67.



A. Distoma hæmatobium, the female lying within the male. × 10. B. Eggs of distoma hæmatobium. × 150. (LEUCKART.)

occur in separate individuals. The female is a slender, thread-like worm about three-fourths of an inch long, and the male is about one-third less. The eggs are ovoid, and are furnished with a spinous process at one extremity. They are deposited in the capillary vessels of the liver, the intestines, the kidneys, the ureters, and bladder, pro-

ducing in the intestinal canal lesions similar to those observed in dysentery. In the urinary tract their presence occasions frequent and dangerous hæmaturia.

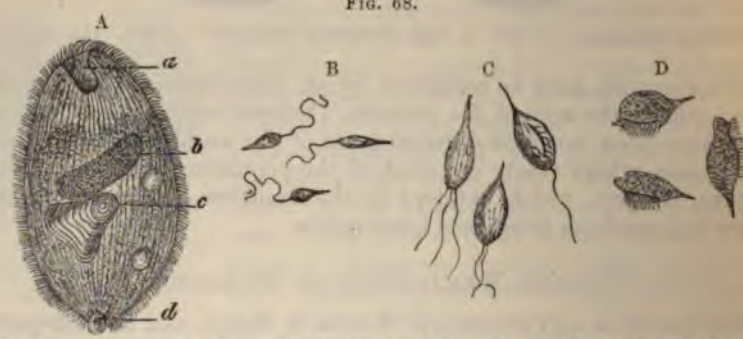
The diagnosis depends upon the discovery of the spinous ova in the feces and in the urine. No specific treatment has yet proved successful.

CHAPTER II.

PROTOZOA.

VARIOUS forms of amœba have been recently discovered in the mucus of the intestines (Fig. 68), vagina, and bladder of patients in

FIG. 68.



A. Balantidium coli. (CLAUS.) *a*. Mouth. *b*. Nucleus. *c*. Starch granules. *d*. Foreign body in the act of extrusion. B. Cercomonas intestinalis. (DAVAINE.) C. Trichomonas vaginalis. (KÖLLIKER.) D. Trichomonas intestinalis. (ZENKER.)

different parts of the world who suffer with various diseases of those organs. Certain representatives of the *sporozoa*, notably *coccidium oviforme*, have been observed in man (Fig. 69.) These are unicellular organisms, ovoid in form and provided with a nucleus, that remain immovable throughout the entire period of development. They exist in the interstices, or within epithelial cells of the tissues, where they become encysted and produce spores. They have been overlooked by reason of their close resemblance, in certain stages of development, to the nuclei of the epithelial cells and the leucocytes which they infest. They have been observed in the bile-ducts and in tumors of the

FIG. 69.



Coccidia from the human liver. *a*. × 300. *b*, *c*. × 1000. (LEUCKART.)

liver. In the skin, certain species of this parasite produce cutaneous diseases, such as *Paget's disease* of the nipple, *acne cornea*, and possibly *molluscum contagiosum*. Similar parasites have recently been discovered in various forms of epithelial tumors, in uterine cancers, in cirrhosis, and atrophy of the liver. These discoveries seem to open a wide field for future research.

In the fecal discharges of typhoid fever, chronic diarrhœa and cholera, a minute animal parasite, *cercomonas intestinalis*, has been observed. The pathological significance of these and similar monad parasites has not yet been precisely ascertained. Klebs has recently advanced the hypothesis that the blood corpuscles in certain cases of pernicious anæmia are destroyed by various protozoa. The same author affirms that goitre and cretinism originate in the presence of certain flagillariæ in the drinking-water of districts where these diseases prevail.

CHAPTER III.

MALARIAL FEVER.

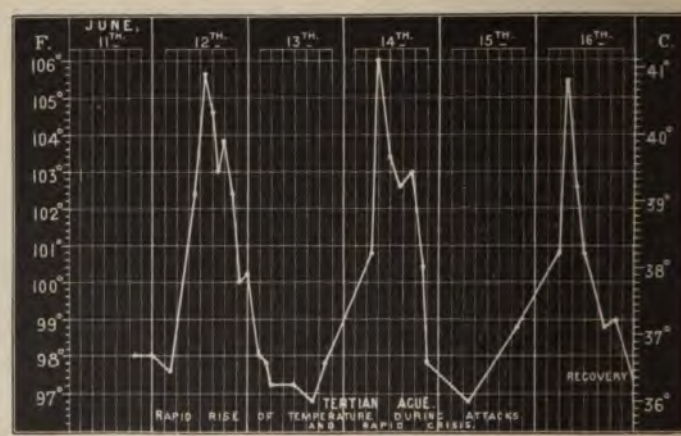
Malarial fevers are caused by the action of malaria, of which the nature will be considered in a subsequent paragraph. They are encountered chiefly in the tropical regions of the earth, and, during warm weather, in the temperate and sub-tropical zones. Generated in swampy localities, they are for the most part experienced in low lands lying near the seashore, or along the borders of large rivers. Apparently dry soils sometimes yield malaria, but they are underlaid by a layer of clay or rock that prevents proper drainage, so that the subsoil is actually in a swampy condition. Tracts of land that are alternately overflowed with water and dried by the heat of the sun are prolific sources of malaria, especially when first disturbed by the processes of agriculture or by extensive excavation for any other purpose. A dry season following a wet favors the production of malaria. Changes in the mode of drainage, and interference with the free circulation of water, by the construction of dams or the draining of ponds, may liberate malaria in long-settled countries where previously it had been unknown.

Long settlement and perfect drainage, on the contrary, may banish malarial diseases from localities originally scourged by them.

Malarial diseases are grouped under four principal forms: 1, *intermittent fever*; 2, *remittent fever*; 3, *pernicious fever*; 4, *malarial cachexia*. Of these, intermittent fever is the mildest form, and is the most frequent in northern climates, where the disease only prevails during the heated months of the year. Remittent and pernicious fevers are most commonly experienced in tropical and in sub-tropical countries.

Intermittent Fever. This variety of malarial fever, commonly called fever and ague, is of frequent occurrence during the later months of summer in localities where malaria is endemic. It sometimes occurs during the winter and spring, but such cases result from previous infection during the summer, since it has been observed that malaria is developed only when the mean temperature of the air is continuously above 60° F. The fever consists of a succession of paroxysms, separated from one another by an interval of variable duration during which the temperature of the body is normal. The ordinary form of intermittent fever of moderate type is characterized by the occurrence of a paroxysm on every other day. This is called *tertian intermittent fever.* (Fig. 70.) When the type of fever is more

FIG. 70.



Intermittent fever—tertian ague; temperature in axilla. (FINLAYSON.)

severe, the paroxysms recur every day, constituting the *quotidian fever.* Sometimes the paroxysm recurs upon the fourth day, constituting a *quartan fever.* There is also a liability to recurrence after an interval of six or seven days. These constitute the regular types of intermittent fever, but sometimes there are reduplications of the paroxysms. Quotidian fevers overlap one another so as to produce two paroxysms each day. Tertian fevers may also overlap so as to produce daily paroxysms with characteristics different from those of the regular quotidian type. Thus a double tertian may exhibit similar paroxysms on the first and third days, with another pair occurring upon the second and fourth days, but differing from the paroxysms of ordinary quotidian fever by irregularity, either in the hour of recurrence or in the characteristics of the paroxysms.

Other variations in the succession of the febrile paroxysms have been noticed, but are without particular importance.

DESCRIPTION OF THE DISEASE. For several days previous to an attack of the fever the patient may experience sensations of lassitude, headache, loss of appetite, and vague disturbance of the health. These

sensations may recur for a limited period every day, or every other day, until they finally culminate in a fully formed paroxysm. Again, the onset of the fever may be sudden, especially if the patient has been exposed to a very concentrated form of malaria. The paroxysm usually commences shortly before noon, but it may begin at any hour of the day or night. It consists of three successive stages: the cold, the hot, and the sweating stage.

The cold stage. The surface of the body is cold; the countenance is pale and pinched; the skin is contracted and roughened by spasm of the cutaneous muscles. The pulse is small and feeble; respiration may be hurried; there is headache; the tongue is pale; saliva deficient; often there may be nausea and vomiting; the patient shivers and feels cold, though the temperature of the body is actually rising above the normal degree. This stage may continue from a few minutes to several hours. Its duration is usually about an hour.

The hot stage. The patient ceases to shiver, and experiences an agreeable cessation of cold and tremor. A sensation of warmth gradually pervades the whole body, and deepens into a dry and burning heat. The face appears flushed; the eyes become injected and red; the arterial muscles relax; the pulse becomes full and bounding; respiration is hurried, and the temperature rises to 106° F., or even higher. There is headache and backache, sometimes even delirium, and in children there may be convulsions. The urine, if voided, is scanty and high-colored, and its nitrogenous constituents are increased. Loss of appetite is complete, and there is great thirst. This stage may continue from two to eighteen or twenty hours. In regular intermittent fever the shorter period is more common.

The sweating stage. Perspiration appears first upon the forehead, and gradually moistens the entire surface of the body. Sensations of pain, heat, thirst, nausea, and general discomfort subside, and the patient gradually returns to apparent health. At the close of the paroxysms the temperature may fall one or to degrees below the normal standard, but it soon returns to the characteristic level of health, and the patient appears to be well until the commencement of the next paroxysm, which, in the quotidian type of fever, recurs upon the next day, but in the tertian type is postponed until the third day. This period of apparent health between the close of a paroxysm and the commencement of the next, is called the *intermission* of the fever. The period occupied by a single paroxysm and intermission is called the *interval* of the fever. Long-continued paroxysms and brief intermissions indicate a severe form of fever, while brief paroxysms and long intermissions indicate the opposite type.

If the evolution of the fever proceeds with increasing severity, the paroxysms tend to recur at an earlier hour of the day; such fevers are said to anticipate their paroxysms. In that way a tertian fever may be transformed into a quotidian. When, on the contrary, a fever is becoming milder, its paroxysms may be successively postponed to later hours of the day, and thus a quotidian fever may become a tertian.

PATHOLOGICAL ANATOMY. Since the mortality of intermittent fever is very low, it is not often that the opportunity presents for examination of the bodies of patients who have died with the uncomplicated disease. The spleen and liver are similarly enlarged, and contain an increased quantity of pigment. The muscular fibres of the heart are pale and softened, as a result of the elevated temperature experienced during the paroxysms. The red corpuscles of the blood are diminished in number, while the white corpuscles have become more numerous. The power of coagulation is greatly reduced, and the serum that separates from the imperfectly organized clot is stained with the hæmoglobin of the disintegrated corpuscles. But the most characteristic change consists in the presence in the blood of the protozoon, *plasmodium malariæ*, described elsewhere.

TREATMENT. During the paroxysm of intermittent fever the patient should be made as comfortable as possible. This may be effected by the recumbent position. During the cold stage he may be warmly covered in bed, and may be allowed warm and stimulating drinks. Nausea may be relieved by the application of mustard to the epigastrium, and discomfort may be greatly diminished by the hypodermic injection of morphine and atropine. The paroxysm may be, in fact, aborted by the administration of one or two half-drachm doses of chloroform swallowed with ice-water. If nausea and vomiting do not contra-indicate, ten grains each of calomel and jalap may be given with advantage at the commencement of this stage; or, if nausea be considerable, twenty grains of calomel laid upon the tongue may be followed by one or two soda-mint tablets.

During the hot stage the comfort of the patient will be considerably increased by cold sponging of the surface, by cold drinks, by the use of aërated waters, or by the frequent exhibition of scruple doses of potassium bicarbonate in iced lemonade.

The complete establishment of the sweating stage is the signal for the administration of quinine. This should be given in divided doses until twenty or thirty grains, according to the severity of the case, have been taken. It may be given in several large doses—ten grains every six hours—or in three-grain doses every hour until the full amount has been administered. If possible, the drug should be given in solution or in wafers. Pills are objectionable, because they are often insoluble in the stomach. Various disguises may be necessary in dealing with children, to whom the tannate of quinine may be given in syrup of licorice or in the form of tablets compounded with chocolate. If the stomach be very irritable, the drug may be administered by enema, having first washed out the rectum with clear water. If the case be very urgent, the acid hydrochlorate or the acid hydrobromate of quinine may be dissolved in a small quantity of water and administered hypodermically in doses of one or two grains, often repeated. If, for any reason, quinine cannot be employed, Fowler's solution of the arsenite of potassium may be used as a substitute. This should be given in five-drop doses, repeated every four hours, for a number of days. By this means a recurrence of the paroxysm will usually be prevented.

To obviate the danger of relapses, it will be found expedient to administer the following pill:

℞.—Acid. arsen. } āā gr. j.
Strych. sulph. }
Aloin } āā gr. ij.
Podophyllin }
Quin. sulph. ʒss.
Ol. res. piper. nig. gtt. xxx.—M.

Ft. pil. no. xxx.
Sig. One pill three times a day.

Warburg's tincture, in drachm doses, repeated three or four times a day, is a favorite remedy among the English in India.

The patient should be kept saturated with quinine for more than a week, to avoid the danger of relapse; and larger doses of the drug may be given at the end of each weekly interval, until the health is fully restored.

Remittent Fever. This fever, frequently called *bilious fever* or *remittent fever*, differs from intermittent fever in the fact that the successive paroxysms are not separated from one another by a period of normal temperature. The temperature remits, but does not fall to the normal standard. It is the common form of malarial fever in warm climates and in localities where the malarial poison is highly concentrated. It is consequently the scourge of the tropics and of the newly settled localities in the southern and western portions of the United States. Like intermittent fever, the types of the disease may be quotidian, tertian, quartan, etc. The paroxysms are sometimes brief, and sometimes so long continued that the remission can be scarcely observed. They sometimes manifest the successive stages of cold, heat, and sweating, as in intermittent fever; but in other cases the distinction of the separate stages is not well defined, the tendency to continued high temperature overpowering the cold stage and the sweating stage. In some instances it is difficult to distinguish between severe intermittent and mild remittent fever. Generally, however, the course of the disease is marked by a greater intensity of all the manifestations, indicating a degree of intoxication more profound than exists in intermittent fever.

Description of the Disease. For two or three days before the access of the fever the patient experiences some degree of depression and disturbance of the functions of digestion, with languor, low spirits, and disinclination to exertion. The symptoms of disordered digestion and deficient nerve-power are the most prominent. Sometimes, however, the attack is quite sudden, especially if an unacclimatized patient have been exposed to severe heat and exhaustion in a malarious locality. The initial paroxysm commences quite abruptly, but the cold stage is usually of short duration, quickly yielding to the hot stage, which is prolonged beyond the corresponding stage of intermittent fever. There is headache; severe pain in the back and limbs; a flushed face; redness of the eyes; dryness of the skin; large pale tongue, often indented at the edges; dryness of the mouth; frequently intense nausea and vomiting of bilious matter. Sometimes there is hiccough, or a dis-

tressing sensation, as if a hair or a piece of a feather had been lodge in the pharynx; the pulse rises rapidly, and the temperature soo reaches 106° or 108° F. Sometimes the nose bleeds; the bowels a usually constipated, or there may be a bilious diarrhœa; the urine acid, high colored, scanty, with an increase of nitrogenous elemer This stage continues from six to eighteen hours; then a gentle pers ration gradually appears upon the surface, all the symptoms of h fever and restlessness subside, and the patient falls into a quiet sl The temperature gradually descends, but does not fall to the nor standard. In ordinary cases the hot stage continues from about n until midnight; the temperature then begins to fall, and the remiss is established shortly before daylight. In severe cases the remiss may be very brief or scarcely discoverable; in mild cases it may c tinue until late in the forenoon. The hot stage is then repeated, the same round of symptoms is renewed. If the course of the feve marked by increasing severity, the remissions grow shorter and paroxysms become more intense. As the fever subsides toward c valescence the remissions grow longer, until complete intermissi separate the successive paroxysms, as in ordinary intermittent fe During the course of the fever delirium may appear. Sometimes may deepen into stupor or coma, terminating in death. More quently the patient is only restless, wakeful, and uneasy.

The duration of the disease is exceedingly variable. It may c tinue for two or three weeks before the commencement of improveme It may terminate fatally at any time after its commencement. It n gradually subside into a typhoid condition of uncertain duration result. A favorable termination may occur by crisis, the fi paroxysm ending abruptly with a copious perspiration or a criti discharge from the bowels or kidneys. More frequently, howev recovery takes place, with a gradual subsidence of all the sympto that mark the acute stage of the disease. The dry mouth becon moist; the tongue begins to clean at the tips and edges; nerv symptoms subside; sleep becomes more refreshing; temperature comes gradually less, and convalescence is finally established. Wh the disease assumes the intermittent type during convalescence, daily paroxysms may recur for a considerable period of time, but th become less severe, and finally disappear altogether.

In many of the severe forms of the fever, during the second we of its course the regularly remittent type of the disease is merged i typhoid condition. The pulse increases in rapidity while diminished strength. The temperature is high and unevenly distributed; tongue becomes dry, brown, and hard; the teeth and lips and lini of the mouth are coated with sordes; the bowels may be either c fined or frequently and unconsciously evacuated; secretion of ur becomes scanty, and the bladder may be distended by retention; mind is obscured by delirium that is rapidly merged in stupor and con the body emaciates, and death may occur at any time between second and fifth or sixth week. Recovery sometimes takes place e from this desperate condition. The most favorable indications under su circumstances are found in the subsidence of nervous symptoms and

restoration of secretion, as shown by a return of moisture to the mouth, and the disappearance of sordes and fur from the tongue. In such cases the tongue generally throws off its coating, leaving the surface smooth and red, and often presenting a glazed appearance. Recovery under such circumstances is usually very tedious.

DIAGNOSIS. Typical cases of remittent fever may be easily recognized, but if the typhoid condition be developed it may be difficult to distinguish this from a corresponding condition in typhoid fever. The mode of onset, the rapid development of high temperature, the remittent course of the disease, the absence of diarrhœa, rose spots, and tympanitic distention of the abdomen, favor the diagnosis of remittent fever. In countries where yellow fever prevails the question of differential diagnosis may arise. From yellow fever it must be distinguished by its longer course, by its distinctly remittent type, by the rarity of hemorrhage from the stomach, intestines, and urinary passages, and by the marked influence of quinine in its treatment.

PATHOLOGICAL ANATOMY. The liver and the spleen are much enlarged and deeply pigmented; the gall-bladder is frequently filled with thick and tar-like bile; the mucous membrane of the stomach and intestines is thickened and softened; the red corpuscles of the blood are greatly diminished in number; the muscular fibres of the heart are pale and softened.

PROGNOSIS. Despite the severity of the fever its mortality in temperate climates is not very high. In the malarious regions of the tropics, on the contrary, the mortality from this fever is very great. During the civil war, from 1861 to 1865, the mortality in the United States army from remittent fever was 13.45 per thousand, but in tropical countries, and without treatment, the mortality is far greater. So much depends upon these various factors that it is impossible to assign any universal rate of mortality.

TREATMENT. The bowels should be evacuated as speedily as possible with the aid of a mercurial cathartic. A dose of calomel and jalap, or three or four compound cathartic pills, will be sufficient for this purpose. If the stomach be irritable, and there is bilious vomiting, perhaps associated with bilious diarrhœa, ten or twenty grains of calomel may be placed upon the tongue to be washed down with an effervescing draught or with ice-water, and a mustard plaster should be applied to the pit of the stomach. This may be followed in the course of two or three hours with an effervescent solution of the citrate of magnesia, a Seidlitz powder, or any other saline purgative. As the temperature rises, antipyrine may be given in five grain doses that may be repeated sufficiently often to reduce the temperature and to favor moderate perspiration. If the circulation manifest any sign of failure, phenacetine should be preferred to antipyrine. Nausea may be greatly relieved by the frequent administration of minute doses of morphine—the thirtieth of a grain every fifteen minutes until relieved. With this may be conjoined corresponding doses of dilute hydrocyanic acid. During the hot stage the skin may be cooled by frequent sponging and by the use of cooling beverages. As soon as the temperature begins to subside, and the remission is established, quinine should be administered,

as in the treatment of the similar stage of intermittent fever. Duri
the course of the disease the patient should be kept under the full in
ence of quinine, administered in divided doses to the extent of from
to twenty grains during the twenty-four hours. Restlessness
wakefulness may be combated with the various hypnotics, such
chloral, sulphonal, bromidia, paraldehyde, Hoffmann's anodyne, Dov
powder, and the various opiates. The typhoid condition requires
porting treatment, with careful nursing and feeding. The diet sh
be restricted to liquids, milk, gruel, toast-water, and thin broths. E
nog and alcoholic stimulants will be required in cases that
marked by typhoid symptoms. Cardiac failure, gastralgia, hicco
and kindred nervous disturbances will be relieved by organic sti
lants, of which capsicum, camphor, nux vomica, and small dose
opium, are the most valuable. During convalescence the bowels
often constipated, requiring the use of compound rhubarb pills or l
tive enemata. The appetite may be somewhat deficient, needing
stimulus of simple bitters, like the compound infusion of gentian
the elixir of calisaya bark, or any other similar vegetable preparat
Tonic doses of quinine should be continued for a long time, as rec
mended after intermittent fever.

The patient must not be allowed to gratify his appetite in an un
sonable manner. The diet must be restricted at first to bread, roa
potatoes, farinaceous food, with eggs, broth, and the tenderest meat
small quantity, gradually ascending the scale from the lighter varie
of food to the coarser and more substantial articles.

Pernicious Fever. During the paroxysms of intermittent and re
tent fevers a tendency to more than ordinary prostration, stupor,
diac failure, or gastro-intestinal disturbance is sometimes remar
In these cases the danger of the fever is correspondingly increased,
may reach a degree that is designated by the term *pernicious feve*
form of the disease that without energetic treatment is usually fa
The pernicious tendency is ordinarily manifested in the course of w
appears to be a common malarial fever. Suddenly the symptom
danger are displayed. They may principally affect the cerebral org
the respiratory and circulatory organs, or the gastro-intestinal tr
The *cerebral form* of the disease is characterized by stupor deepe
into coma, similar to that which is manifested in the course of apopl
Convulsions have also been observed. From similar conditions of
plexy this form of pernicious fever must be distinguished by the abse
of hemiplegia, and by its manifestation during the course of a mala
fever, or in a person obviously exposed to malarial infection.

In the *cardiac form* of the disease the medulla oblongata is re
the seat of oppression, with consequent tendency to failure of resp
tion and circulation. In this form the patient complains of cold o
heat, though actual rigors are usually absent. The skin is pale,
countenance pinched, perspiration drips from the surface of the bo
the voice becomes husky, respiration is shallow and inefficient, the p
disappears. The patient usually becomes unconscious before de
From this condition of great prostration he may partially rally
the subsidence of the paroxysm, which, if neglected, will be a

this pigmentation. Even the corpuscles of the blood contain pi granules, constituting the condition called *melanæmia*.

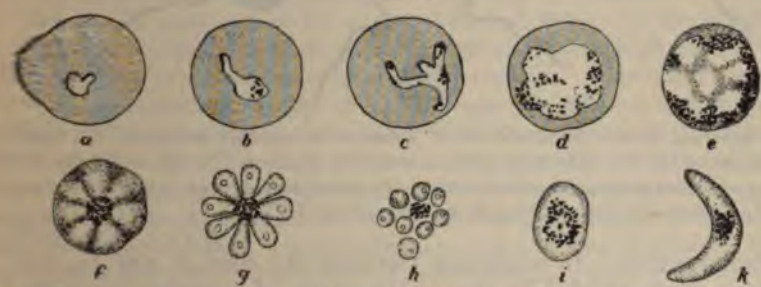
TREATMENT. Removal from the malarious locality is the first site for successful treatment. It is sometimes sufficient to effect porary change of residence. Children suffering with intractable mittents may often be cured by the simple expedient of excha homes, for a short time, by two infected families. Violent excit nervous shocks, and deep emotion sometimes accomplish the result, but if the cachexia be profound and of long duration, a cc removal of the patient to a healthful climate must be accomplish is worthy of note that in the medicinal treatment of such p large doses of quinine are comparatively ineffectual. Better res reached through the use of arsenic, iron, and strychnine, combin aromatics and gentle cholagogues, as in the pill previously mended. The elixir of iron, quinine, and strychnine, or the e iron, quinine, and arsenic, is an excellent preparation, and it administered in drachm doses after each meal, for many mont all cases constipation of the bowels should be avoided, and the fu of the kidneys must be carefully maintained. Whenever anti remedies fail to produce an immediate or successful result, the should be stimulated for three or four days with alkaline diureti as potassium acetate, citrate, or nitrate. A few medicinal doses pyrine will often be found serviceable as an introduction to a odic treatment in chronic forms of ague. Warburg's tincture is value in many cases. One of the most effectual means of res from the chronic indigestion and lithæmia that so frequently fol larial fevers consists in the administration of strong nitric acid d period of three or four weeks. Five drops of the acid should be with six or eight ounces of water, and should be drunk by suction a glass tube, in order to avoid injury of the teeth. This dose repeated three or four times a day with the greatest adv Chronic enlargement of the liver and spleen may be treated l inunctions over these organs with ointment of the biniodide of n Exposure of the skin to sunshine or to the heat of the fire after tion adds to the efficacy of this proceeding.

ETIOLOGY. The conditions under which malaria originat been already considered. The nature of the infective poison d attention. The volatile character of the infection has alwa remarked. Rising from the surface of the soil with watery va the upper regions of the atmosphere, the lower strata of air comparatively free from malaria during the daytime, but become charged with the poison at night, when the vapors are conden descend in the form of dew. Hence the greater danger from e to the open air at night. Transportation of malaria by the v been frequently observed: residents upon the leeward side of rious swamp suffering severely, while residents upon the windw escape. The interposition of a grove of trees or a consider between such marshes and human habitations has also proved s as a screen in the course of prevailing winds, so that the reside the leeward side of such a screen are efficiently protected f

malaria, which is projected above the level of their habitations with the ascending currents of air. Thus, it seems that the poison of malaria must be something that can be carried like smoke by moving currents of air. It is also to some extent capable of diffusion through the medium of water, and may thus enter the body with water that is drunk. But this mode of infection is less effectual than its introduction through the respiratory passages.

A conviction of the particulate character of the infective matter of malaria led observers long since to microscopical examination of the air in malarious regions. Various forms of bacteria have been studied and considered as the infective agent. Notable among these researches are the investigations of the Italians who have experimented extensively with the air, the water, and the soil in the environs of Rome. But these researches have never carried conviction to the minds of all pathologists, and the bacterial origin of malaria still seems highly improbable. In 1881 a French army surgeon, named Laveran, published his discovery of a protozoic parasite in the blood of patients suffering with malarial diseases. To this parasite was given the name *plasmodium malariæ* or *hæmoplasmodium*. (Fig. 71.) It exists free

FIG. 71.



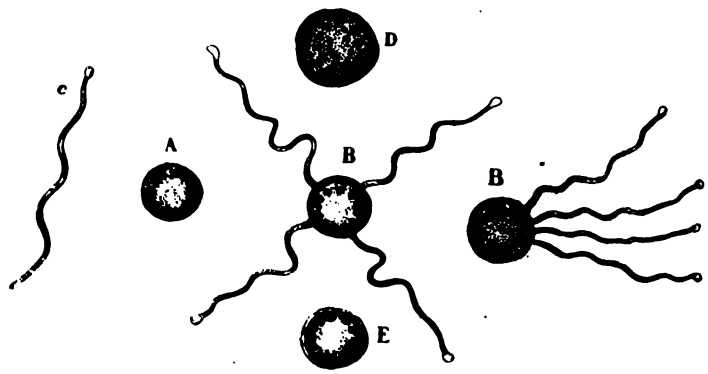
Plasmodium malariæ from the different stages of a quartan fever. *a*. Red blood-corpuscle including a small parasite. *b, c, d, e*. Pigmented plasmodia of different sizes occupying the interior of the red blood-corpuscles. *f*. Commencement of segmentation with central deposit of pigment. *g*. Plasmodium undergoing segmentation. *h*. Spherical division of plasmodium. *i, k*. Two different forms of free plasmodia. (GOLGI.)

in the blood plasma, or applied closely to the substance of the red blood-corpuscles, either within or without their periphery. During a certain stage of its development it contains minute granules of blood pigment. It exhibits amœboid movements, and is surrounded by a number of slender movable filaments or flagella. (Fig. 72.) These may become detached, and may float freely in the plasma.

It is at the commencement of the febrile paroxysms that these parasites are most numerous in the blood. They attach themselves to the red corpuscles, become charged with pigment, divide into segments which become motionless, often crescentic in form, and are broken up and carried away, apparently by the white corpuscles that discharge the pigmented mass into the spleen and the liver, which thus become loaded with pigment. With the commencement of each successive

paroxysm the hæmatozoa again appear, probably as a successive generation of descendants from the mature parasites which propagate themselves through the medium of spore-like germs. These parasitic forms rapidly disappear under the influence of quinine. It has been suggested that the different types of malarial fever are conditioned by different varieties of the infective protozoon. Malaria may be communicated to healthy individuals by the intra-venous injection of blood containing plasmodia, and the type of the fever thus communicated corresponds with the form exhibited by the patient from whom the blood was derived.

FIG. 72.



A. Spherical form of plasmodium. B. Sphere with movable filaments. B'. Lateral placement of the movable filaments. c. Detached filament. D. Spherical body filled with granules of pigment in active motion. E. Spherical body treated with osmic acid, showing the double contour of the mass. (HALLOPEAU.)

PROPHYLAXIS. In malarious localities the disease may be, to a certain extent, avoided by care in the matter of exposure to excessive heat, fatigue, and intemperance of all kinds. Warmth must be secured in every habitation, even in warm climates by the use of fires, at night, at least, if not needed during the daytime. Small doses of quinine, two or three grains at meal-time, taken daily during the period of sojourn in an unhealthy region, are an indispensable means of protection against attacks of fever. In this way it may become possible to reside for years with safety in a place where health could not be maintained for a single season without such prophylaxis.

CHAPTER IV.

DYSENTERY.

DYSENTERY is a specific inflammation of the large intestine that prevails endemically in many tropical regions of the earth, and may occur epidemically in any part of the temperate zones where favoring conditions arise. More widely and frequently prevalent than cholera, yellow fever, or the plague, it destroys a larger number of victims than any or all of those diseases. During the civil war in the United States one-third of the admissions to the hospitals were caused by intestinal disorders of a dysenteric character. Everywhere, in all ages, it has been the scourge of armies, often arresting the march of victorious hosts and bringing to an inglorious termination the most promising campaign.

SYMPTOMS. The period of *incubation* is often absent. In other instances exposure to the specific contagion of the disease is followed by no morbid consequence for a long period of time. In the majority of cases the period of *invasion* is characterized by a slight diarrhœa, without fever or serious disturbance of the health. The occurrence of previous diseases, especially those that are malarial or scorbutic in their character, generally occasions a rapid development of the dysenteric attack. The disease then commences abruptly with the characteristic symptoms; severe paroxysms of colic (*tormina*), tenesmus, and frequent muco-sanguinolent stools. With this aggravation of the initial diarrhœa the abdomen becomes swollen, and a certain degree of fever appears. The patient complains of considerable debility; there is loss of appetite and the power of digestion; the urine becomes high-colored and scanty; there is frequent pain in the colon, extending into the rectum and reaching into the anus, provoking a continual desire to evacuate the bowels, accompanied by a sensation as if something of a solid character must be expelled from the rectum. Occasionally small masses of fæcal matter, covered with mucus and streaked with blood, make their appearance. But the principal result of the repeated and protracted efforts of the patient is the discharge of a small quantity of slimy matter containing more or less blood, and closely resembling the tenacious muco-sanguinolent expectoration of pneumonia. In certain cases this incessant effort causes a prolapse of the rectum itself. The frequent repetition of these paroxysms, sometimes occurring fifteen to twenty times every hour, renders sleep impossible. The patient rapidly loses flesh and strength; the features collapse and express the utmost degree of weariness and pain; but the intellectual faculties remain undisturbed.

In moderate forms of the disease these symptoms continue four or five days, and then gradually decline; pain subsides, the stools become normal, and the patient slowly returns to health.

But in severe forms of dysentery as it assumes the epidemic character under conditions unfavorable to health, or as it prevails endemically in warm climates, the disease continues with increasing gravity. The stage of *tissue destruction* is now reached. The stools lose their mucous character, and become liquid in consequence of the destruction of the intestinal mucous glands. Fever continues and assumes a typhoid character; there is intense thirst; the mouth becomes dry; the tongue red, pointed, smooth, and shining from the loss of its epithelial covering; the abdomen sinks, tenesmus ceases; the sphincter ani muscle becomes so relaxed that the interior of the rectum is sometimes visible through the patulous anus; the liquid stools exhale the odor of putrefaction, and consist of a sero-sanguinolent fluid that resembles the washings of beef; the urine is scanty and sometimes suppressed, or is replaced by a few drops of a burning, purulent liquid. The voice becomes hoarse, enfeebled, and finally extinguished; the extremities grow cold; pain ceases. Hiccough supervenes; the pulse becomes more frequent and thready; respiration is accelerated; the face becomes cadaverous, and death occurs from complete exhaustion though the mind frequently retains its conscious intelligence until the end of life.

If the disease does not thus reach a fatal termination, the symptoms may gradually subside, and recovery may occur.

The rectum is the portion of the intestine in which the disease lingers after the upper portions of the gut have returned to a state of health. In these cases the stools resume their normal appearance and time of evacuation, but the fæcal cylinders bear upon their surface mucous purulent and bloody discharges from the ulcerated surfaces over which they pass.

In warm climates and under unfavorable conditions, acute dysentery is very likely to pass into the *chronic* form of the disease, which may linger indefinitely, and may finally wear out the life of the patient. The passage from the acute form to the chronic form takes place by insensible degrees, so that it is difficult to define the limits between the two varieties of the disease. Among patients who have been previously debilitated by malaria, scurvy, intemperance, old age, and other causes of exhaustion, the disease tends to assume a chronic character from the very outset of the disorder. There is but little fever and comparatively slight abdominal pain; the intellect is undisturbed; the patient complains of weakness, and lies upon the side with the knees bent and the thighs drawn up against the belly. He experiences great sensitiveness to changes of temperature; the stools are no longer tinged with blood but are of a thin brownish-yellow color, often sero-purulent, and contain particles of undigested food. There is no longer colic nor tenesmus, but the slightest exposure to cold, movement of the body, or even the swallowing of food, is sufficient to provoke evacuation of the bowels which are rendered especially painful by the inflammation and ulceration of the anus. The appetite is preserved, but digestion and assimilation are almost completely arrested. The tongue resembles raw beef-steak; blood sometimes oozes from the mucous membranes of the mouth; the breath exhales a cadaveric odor; the skin becomes dr

brown, rough, and almost scaly; the mucous membrane of the bladder ulcerates; the consequent vesical tenesmus is sometimes intolerable; the scanty urine is loaded with mucus and pus. Emaciation is extreme, rivalling that of pulmonary consumption. During the last stages of the disease the limbs become œdematous; the eyes sink in their sockets; purulent conjunctivitis and ulceration of the cornea sometimes occur; the mouth and throat also become ulcerated; the skin becomes necrotic wherever it is subjected to pressure over the bony prominences of the skeleton; ecchymotic spots appear upon the skin; erysipelas may attack the face; the intellectual faculties finally give way, and the patient dies in the last degree of emaciation and exhaustion.

Diagnosis. Acute dysentery may be distinguished from *proctitis* by an exploration of the rectum, hemorrhoidal swelling and inflammation being present in simple inflammation of the rectum, while the graver disease is attended by acute ulceration.

The rectal tenesmus that produces a discharge of sanguinolent mucus from the bowels a few days after childbirth, and the similar condition that is sometimes presented by the victims of stone in the bladder, can scarcely be mistaken for the symptoms of genuine dysentery.

Chronic dysentery may be distinguished from *cancer of the rectum* by local examination. *Chronic tubercular diarrhœa* closely resembles chronic dysentery, but may be distinguished from that disease by the previous history of the patient and by the tubercular invasion of other organs. From the *chronic diarrhœa* of the tropics it may be distinguished by the early history.

Prognosis and Mortality. Dysentery as it appears under conditions favorable to recovery in temperate climates is rarely dangerous or fatal. Under such circumstances it seems to be a self-limited disease that terminates in recovery after one or two weeks. No disease, however, is more liable to relapse, for it does not protect against itself; and each successive attack increases the susceptibility of the patient to subsequent attacks. No disease is more easily aggravated by unfavorable hygienic conditions or by cachectic states of the body. No disease tends to become more persistent and incurable the longer it is permitted to exist. By reason of the great variations in the conditions that control the prevalence of the disease, its mortality exhibits a corresponding degree of variation. While in the acute dysentery of Europe the mortality does not exceed 6 per cent., in warm climates it rises to 25 per cent., and in certain epidemics it has been known to exceed 50 per cent. The mortality of chronic dysentery is about 80 per cent.

Pathological Anatomy. After death from acute dysentery the mucous membrane of the large intestine appears swollen by an intense congestion which reaches to a variable distance up the course of the colon, and may invade the small intestine itself. The inflamed surface is covered with mucus mingled with blood that has escaped from numerous visible hemorrhagic points. Actual necrosis of the surface becomes apparent in certain parts of the mucous membrane. Two forms of inflammation may be differentiated, though frequently asso-

ciated together in the same patient: 1, the *catarrhal* form, and 2, *diphtheritic* variety.

The *catarrhal* form occupies the superficial structures of the muc membrane, and is characterized by exfoliation of the epitheli especially upon the prominent convolutions of that membrane.

The *diphtheritic* form differs only from the first by a deeper infil tion of the intestinal walls. This process may involve the whole s mucous structure, even invading the muscular layer. The gland organs seated in the intestinal wall take part in the inflammatory cess, and become centres of ulceration. From these points of depar the mucous layer may become undermined by suppuration and necr

In *chronic dysentery* the ulcerative process results in exten destruction of the tissues that compose the intestinal wall. glandular structures disappear, while the bases of the ulcers bec extensively infiltrated and tumefied, thus originating the indur masses that can often be distinguished through the walls of the abdo during the later stages of emaciation. By the formation of cicatr tissues, and by contraction of the inflamed structures, the inte becomes narrowed to a degree that will scarcely suffer the passag the finger through its tube. Perforation of the peritoneal investi of the intestine may take place through extension of the ulcer process. Death, preceded by collapse, then speedily occurs. In m nant forms of the disease the mucous membrane of the intestine rapidly perish and be thrown off in sloughing masses of a gangre character. Fibrinous exudations upon the internal surface of intestine produce a roughened appearance in which the promine are indicative of infiltration in the connective tissue beneath surface.

The spleen is small, firm, and dry, unless the patient has also fered from malarial infection. The bladder is frequently infla and, in chronic dysentery, becomes the seat of extensive ulcera The liver usually presents slight modifications, except in case abscess formed by purulent infection of the organ. Similar absc are sometimes found in the lungs.

Etiology. Dysentery is a disease that prevails more freque and with greater severity as the equatorial regions of the earth approached. It is more prevalent in warm weather than in hence the fact that it becomes endemic in warm climates alone. the temperate zone it prevails during the latter part of summer an the autumn, disappearing during the cold weather of winter. Vari temperatures, such as prevail during the autumn months, favor sud refrigeration of the body after copious perspiration, hence the freq occurrence of the disease during seasons of the year when cold ni succeed hot days.

Slow starvation, errors of diet, unwholesome food, impure water has been contaminated with the products of putrefaction and f excrement, are common causes of dysentery. Similar infection of atmosphere upon battle-fields covered with the decaying bodies of and animals, and in the vicinity of filthy privies, must be numb among the causes of the disease.

There is no satisfactory evidence of the direct transmission of contagion from person to person. It is probable that the infective agent is indirectly transmitted through the fæcal discharges of the patient which find their way into the water-supply by which the food and drink of other individuals are contaminated.

The nature of the infective agent by which dysentery is propagated is not yet fully understood, though it is undoubtedly of parasitic origin. Various microörganisms have been discovered in the inflamed tissues of the intestine. In the tropics and elsewhere, various forms of amœba have been identified in the colon and in the hepatic or pulmonary abscesses that sometimes complicate the disease, and they have been considered as its cause. Various micrococci, minute bacilli, and spirilla, differing slightly from the comma bacilla of cholera, are found in the inflamed tissues of the intestine. They are found in the glandular epithelium, in the connective tissues, and in the lymphatic vessels and glands. It is not possible to distinguish any one of these different parasites as the sole cause of dysentery; it is probable that they all contribute to the evolution of the disease, and perhaps the predominance of different specific microörganisms may be the efficient cause of corresponding variations in the type of the resulting disorder.

FIG. 73.



Amœba coli. (HALLOPEAU.)

TREATMENT. The hygienic treatment of dysentery requires attention to the diet and water-supply of the community. Wholesome food, the avoidance of intemperance in eating and drinking, protection of the body from sudden chill, especially when in a state of perspiration, are the most important items for control. The utmost cleanliness should be required in person and habitation. Thorough ventilation and drainage, with efficient removal or disinfection of all fæcal discharges are imperative. The initial diarrhœa by which dysentery is often introduced, may be treated by evacuation of the bowels with castor oil or with a few grains of calomel, followed by a saline cathartic, such as Rochelle salts, citrate of magnesia, Seidlitz powders, or Epsom salts, to be followed every four hours with a grain of opium and ten grains of bismuth, until the diarrhœa has ceased. Repeated doses of a saline cathartic given till copious watery stools are evacuated often yield an excellent result. The recumbent position, with a flannel bandage around the abdomen will greatly expedite recovery. By many physicians the use of purgatives in this stage of the disease is considered unnecessary, unless there be evidence of intestinal repletion.

When the symptoms of dysentery are fully developed, the indications for treatment are: 1, the relief of pain and tenesmus; 2, the arrest of

inflammation. With these objects in view, the entire abdomen should be covered with a large poultice, which may be rendered more efficient by sprinkling its surface with laudanum and chloroform. Hypodermic injections of morphine and atropine may be repeated as often as required for the relief of pain. If poultices cannot be tolerated on account of their weight or inconvenience, they may be replaced by flannels wrung out of warm water and covered with an oiled silk bandage that encircles the whole body. Tenesmus may be relieved by the employment of opiated suppositories, or by injection into the rectum of an ounce of thin starch, containing thirty or forty drops of the tincture of opium.

By the English physicians in India, ipecacuanha is extolled as the most efficient remedy that can be employed in the treatment of acute dysentery. The powder should be given in doses of twenty or thirty grains, made up into five-grain pills or wrapped in a wafer. A grain of opium may be given at the same time, and the patient should remain in the recumbent position, taking no drink for an hour after receiving the dose. At the expiration of four or five hours, fifteen to twenty grains may be again administered, and for three or four successive days the remedy should be continued, in doses of ten grains three or four times a day. Vomiting rarely follows, though nausea is not uncommon. Copious bilious stools generally follow the treatment with great relief from pain, abundant perspiration, and cessation of the characteristic intestinal disorder. It is said, however, that cases complicated with malarial infection are less amenable to this mode of treatment than the simple forms of dysentery.

Astringent remedies, either vegetable or mineral, are of very little value. The mineral acids are especially useful during the period of convalescence, when they may be given in combination with tonic doses of quinine.

Local treatment of the rectum by the cautious use of warm water slowly injected into the bowel, affords considerable relief by cleansing the inflamed and ulcerated surfaces. The topical application of cocaine in solution to the anal orifice is also of service.

Chronic dysentery is often benefited by change of climate and improvement of the hygienic surroundings of the patient. The diet must contain nothing of an irritating character; milk, koumiss, broths, raw eggs, oysters, the pulp of raw beef, sago, rice, and flour that has been thoroughly cooked and boiled with milk, may be allowed. Bismuth in large doses (one to four drachms) is beneficial. Nitrate of silver, sulphate of copper, and other astringent remedies have been recommended. Ten drops of liquor ferri pernitratis may be given in cold water every three or four hours. But local treatment of the colon with medicated injections affords the best results. The bowel should be washed out every day with a large injection of tepid water, which must be followed by a medicated injection. This should consist of nitrate of silver dissolved in water in the proportion of five grains to each pint of the liquid. By some physicians it has been used in a higher degree of concentration, as much as thirty or forty grains being dissolved in each pint. These injections occasion considerable pain

for a short time, but they are generally followed by relief of all the symptoms. Ulcers that can be reached through the anus may be cauterized with nitric acid, followed by a strong solution of an alkaline salt, as recommended in the treatment of internal hemorrhoids. Obstinate cases have sometimes been cured by daily injections of undiluted brandy. This occasions a burning sensation, soon followed by relief of all the symptoms. A cure has been known to follow the daily administration of a half-pint of castor oil, swallowed at a single dose. Ten drops of the compound tincture of iodine, diluted with half a pint of water, may be given before each meal with advantage. Opiates in all forms should be avoided as far as possible, on account of their unfavorable effect upon the digestive functions.

DISEASES CAUSED BY VEGETABLE PARASITES.

CHAPTER V.

ACTINOMYCOSIS.

This disease is produced by the *fungus actinomyces*, a vegetable parasite that sometimes finds access to the tissues of cattle. The parasite consists of minute granular masses of a sulphur-yellow color, surrounded by radiating crowns of club-shaped mycelia, giving to the fully formed growth an appearance not unlike that of the flower of an aster (Fig. 74). These little bodies are from the tenth to the fortieth of an inch in diameter. By their presence in the tissues they excite inflammation, which results in the formation of abscesses that enlarge and tend to discharge their contents externally. The tumors thus formed are most frequently found in the soft parts between the lower jaw and the integument.

Fig 74.



Actinomyces (from a case of disease in man). (Payne.)

The parasitic organisms having entered the tissues through the cavities of carious teeth, the tumor thus formed enlarges downward, and extends into the neck, leaving a track of cicatricial tissue. Similar tumors may form outside of the upper jaw, and may thus invade the cavities of the face and head, burrowing along the base of the skull and along the vertebral column.

Suppuration finally becomes established, and in the pus may be discovered yellow masses made up of the mycelia of the fungus. Sometimes tumors may form within the lungs, which then become adherent to the walls of the chest. The same process of abscess formation is set up, with a final discharge of pus through the chest wall. From the alimentary canal also, by a similar process, the peritoneal cavity and the adjacent organs may be invaded, with subsequent perforation of the abdominal wall. The suppurative processes thus inaugurated are chronic in their character, and usually terminate fatally, unless the tumors or abscesses are so situated as to permit of removal by surgical aid.

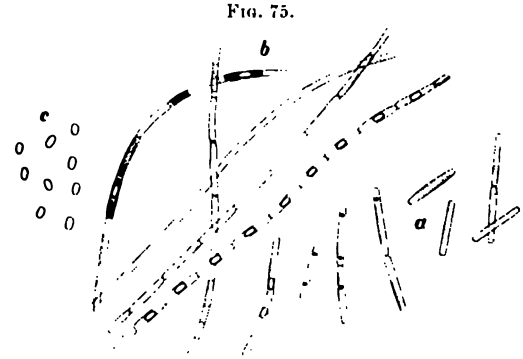
The parasite is seldom communicated from animal tissues to the human subject. It must pass through an intermediate stage of development in vegetable tissues before it can invade the body of man. For this reason infection usually occurs through the chewing of straw, after the manner of horse jockeys and stablemen, who thus become infected directly from the vegetable kingdom, instead of deriving the disease from the animals with whom they associate.

CHAPTER VI.

MALIGNANT PUSTULE—ANTHRAX.

ETIOLOGY. Anthrax is an acute, infective disease, caused by inoculation with virus derived from certain of the lower animals, in which it occurs as a primary affection. Herbivorous animals are most subject,

FIG. 75.



Bacilli anthracis. × 500. *a*. Rods. *b*. Filaments in different stages obtained by cultivation. *c*. Spores. (BRISTOWE.)

by reason of the fact that the contagion depends upon the presence of a bacillus (Fig. 75) (Bacillus anthracis) that flourishes in the soil of certain localities, and attaches itself to the grass and herbage upon which

such animals are pastured. Finding entrance into the respiratory and alimentary passages of horses, cattle, sheep, and other graminivorous animals, the spores of the parasite penetrate all the tissues and pervade every part of the body. The infected animals soon die, and every portion of their decomposing bodies may become a vehicle for the dissemination of the pathogenic organisms that have caused their death. The contagion adheres to everything with which the body has been in contact. Stalls and barns, in which the diseased animals have been kept, thus become centres of contagion for the infection of healthy animals. The earth where a dead body has fallen becomes filled with contagious matter, and even after burial, the soil is infected through the agency of earthworms that bring to the surface particles of mould in which the poisonous bacilli thrive and produce their spores. In this way the disease may become widely diffused, prevailing as an epizootic among the flocks and herds of entire communities. Since every portion of the diseased animal is infected, human beings who are brought in contact with such animals or their products, are excessively liable to contract the disease. Farmers, shepherds, butchers, dealers in hides, horns, and hair, may thus contract malignant pustule by handling such articles when they have been derived from infected animals; the smallest cut, scratch or puncture may admit the virus. It is said to have been conveyed by flies, which have introduced the poison into the skin of the victim.

Anthrax affects animals as a general disease, but when man is inoculated with virus containing the pathogenic bacillus or its spores, the disease appears at first as a local affection upon the surface of the skin. At the point where inoculation takes place is produced a lesion called *malignant pustule*. When the virus is received through the intestinal mucous membrane the local affection is called *intestinal mycosis*. It is not impossible that infection may sometimes occur through the respiratory passages.

Symptoms. *Malignant pustule*. The period of incubation after inoculation continues for about three days. On the fourth day a vesicle appears at the point of inoculation which rapidly enlarges, ulcerates, and presents a livid color, with considerable swelling of the surrounding tissues. The lymphatic vessels that proceed from the affected part become inflamed, and the neighboring lymphatic glands enlarge. There is high fever and great nervous prostration. Death occurs after three or four days, preceded by great exhaustion, cyanosis, and fall of temperature before the fatal termination. In cases of recovery the constitutional symptoms are less urgent, and the disease is more strictly localized in its manifestations. The symptoms of local inflammation gradually subside, cicatrization takes place, and the patient becomes convalescent.

Intestinal mycosis. In this form of the disease the virus finds admission to the body through the gastro-intestinal mucous membranes; cutaneous inflammation is absent, and the external symptoms of malignant pustule do not appear, unless there has been coincident inoculation through the skin. In cases of simple intestinal inflammation there is no period of incubation; the symptoms of disease follow almost

immediately after the invasion of the tissues; sometimes local swellings or vesicles appear upon the skin as a consequence of the constitutional infection. The general symptoms consist of fever, pain in the limbs, back, and head, great nervous prostration, nausea, vomiting, colic, diarrhœa, dyspnœa, petechial spots upon the skin, hemorrhages from the orifices of the body, stupor, coma, muscular spasm, collapse, and death.

In certain cases the local lesions involve the pharynx, producing swelling, ulceration, and gangrene of the pharyngeal tissues. The general symptoms are identical with those that accompany the intestinal form of the disease.

PATHOLOGICAL ANATOMY. The blood is dark and disorganized; the spleen is enlarged, and contains numerous bacilli: the lymphatic glands are also enlarged; the serous membranes present an hemorrhagic appearance. In cases that have been characterized before death by dyspnœa and other pulmonary symptoms the pleural cavities contain a reddish, serous fluid; the mediastinum is infiltrated with a similar liquid, and the bronchial glands are greatly enlarged. The intestinal mucous membranes are swollen and turgid, with hemorrhagic infiltrations. Sometimes ulceration and gangrenous patches are visible. The liver and kidneys, as well as the other organs of the body, contain the pathogenic bacilli in great numbers.

DIAGNOSIS. Malignant pustule must be distinguished from furuncles, carbuncles, and the nodules of glanders. The fact of previous inoculation and the history of the case should assist the diagnosis.

A *furuncle* presents a distinct core, and does not exhibit the lymphatic invasion that characterizes malignant pustule. The swelling of the anthrax pustule is more diffuse and dark in color, and is followed by gangrene of the tissues instead of the simple suppuration and speedy recovery that attend the evolution of a boil.

The formation of a *carbuncle* usually takes place upon the covered portions of the body, and the slough is very slowly developed; while the pustule of anthrax generally appears upon the uncovered portions of the body, and progresses with great rapidity.

The *nodules* of *glanders* are usually developed upon the lymphatic vessels, are several in number, and are connected together by the inflamed and prominent lymphatics. The characteristic nasal ulceration and discharge is absent in cases of anthrax.

The *pharyngeal* and *intestinal* forms of the disease are less easy of recognition, in consequence of the late development of external manifestations, if they occur. The history of the patient, the probability of infection by the use of milk or flesh from infected animals, may serve to arouse suspicion. The rapid and fatal course of the disease and the discovery of the characteristic bacillus, or its spores, will suffice to establish the diagnosis.

PROGNOSIS. If recognized during its early stage, and if subjected to active treatment, the mortality in cases of malignant pustule need not exceed ten per cent. or even less. After constitutional infection has taken place through delay in the recognition of the disease, the mor-

tality reaches forty or fifty per cent. The intestinal form of the disease is almost hopeless.

TREATMENT. The treatment of malignant pustule requires destruction of the local lesion by the actual cautery, or by the use of the most powerful caustics. Having thus destroyed the focus from which general infection would take place, ordinary surgical dressings should be employed, and the strength of the patient must be sustained with tonics, moderate doses of alcohol, and nutritious food, until recovery is complete.

CHAPTER VII.

TYPHOID FEVER.

TYPHOID FEVER is a general disease that is caused by infection of the body with a specific microörganism, the *bacillus typhosus*. It is a disease that is encountered in all parts of the world. It is especially common as an endemic fever in large cities, and among crowded populations who neglect ordinary hygienic precautions.

SYMPTOMS. *Period of incubation.* The period of incubation is variable, sometimes not exceeding two or three days; usually occupying one or two weeks, it may be sometimes prolonged for a month or more.

The *period of invasion* is characterized by lassitude, pain in the back and muscles, loss of appetite, dizziness, insomnia, and a tendency to epistaxis. Occasionally the onset of the fever is abruptly introduced by chill; occasionally, however, the catarrhal condition of the throat and digestive organs constitutes the first symptomatic disturbance. A continuous fever sets in, with a temperature that rises every evening above the temperature of the preceding evening until the latter part of the first week, when the fastigium is reached. During this period of development there is headache, wakefulness, vertigo, coated tongue, diarrhœa, enlargement of the spleen, and a moderate degree of bronchial catarrh.

The fastigium of the fever occupies the second week and the greater part of the third. At the commencement of the second week there is an eruption of rose spots upon the abdominal surface. These disappear under the finger, but reappear as soon as pressure is removed. The occurrence of this eruption is sometimes attended by a brief remission of the fever, and the amelioration of nervous symptoms. The eruption continues until the subsidence of the fever. During the stage of continued fever the tongue becomes dry, sordes accumulate upon the teeth and occupy the nasal passages and pharynx. The tongue is protruded with difficulty, and is sometimes tremulous. There is considerable deafness, the expression of the countenance is dull and heavy, and there is mild delirium, usually more pronounced at night; or the patient sinks into a condition of apathy and stupor. The stools are liquid, fetid, and of an ochreous character. After the tenth day they contain

the bacilli. Sometimes diarrhœa is absent, but the stools when voided present the characteristic color. Vomiting seldom occurs, but there is usually some degree of tenderness over the epigastrium and in the right iliac fossa, where gurgling may be distinguished under the pressure of the fingers. The intestines are often distended with gas, by reason of the paralysis of their walls. The urine is scanty, high colored, and frequently contains albumin, but the amount of urea is diminished. Sometimes there is vesical paralysis, requiring the use of the catheter. The spleen is enlarged, the pulse becomes soft and dicrotic, especially in severe cases. When the respiratory organs are seriously affected the movements of respiration are accelerated.

During the latter portion of the third week, or at some time in the course of the fourth week, defervescence commences. The temperature gradually falls. The expression of the patient exhibits more intelligence, the skin becomes moist, the urine increases in quantity, sometimes there is a critical discharge of urates, or there may be a moderate hemorrhage that is followed by improvement in the condition of the patient. The daily oscillations of temperature become exaggerated, gradually approaching the normal standard during the morning hours, though in many cases rising at evening to the highest point observed during the fastigium.

The period of convalescence is tedious when the preceding fever has been severe. In mild cases recovery is comparatively rapid. All the functions of the body are imperfectly performed, there is great emaciation and anæmia, requiring a long course of reparation. Digestion is performed with difficulty, and food frequently produces nausea and vomiting if pressed too rapidly upon the stomach. The functions of the brain are for a long time enfeebled. Memory and intellectual activity are slowly recovered. Sometimes insanity, various neuroses, tuberculosis, heart disease, and other visceral disorders date from this period.

Certain symptoms of the fever require particular mention. The *temperature* in typical cases rises by successive stages each day, during the first week, until it has reached 104° or 105° F., at night. The maximum temperature is generally observed in the afternoon or evening; the minimum temperature occurs about seven or eight o'clock in the morning; at each time the temperature is half a degree or a degree lower than on the preceding evening. During the fastigium the daily oscillations seldom exceed a degree and a half, and the evening temperature remains quite uniform. During the period of decline more extensive oscillations are frequently observed, especially when complications exist. Notable departures from the typical course of the temperature are not uncommon. Sometimes the disease runs its course without elevation of temperature; sometimes a high temperature is developed as early as the second day; sometimes the maximum temperature is registered in the morning; in certain cases there is a rapid fall of the temperature at the commencement of the period of decline. A definite relation between the severity of the disease and the elevation of the temperature is usually observed. High figures indicate great danger. Recovery rarely occurs when the temperature exceeds 105° or

106° F. When the morning remissions are well marked and prolonged, the fever is usually light. A continuous high temperature is an unfavorable symptom. The persistence of such temperatures during the fourth week indicates the presence of complicating diseases. Death is frequently preceded by extraordinary elevation of the temperature, or by its equally sudden and unusual depression. During the period of convalescence a sudden rise of temperature indicates some intercurrent complication. A relapse of the fever is indicated by a gradual and uninterrupted elevation. In malarious localities the periods of invasion and of defervescence are frequently characterized by an intermittent type of fever.

The condition of the *pulse* affords valuable information regarding the patient. It is more rapid in female patients than in male. During the fastigium, in ordinary cases of fever, the pulse should not exceed 104 beats, or 120 for a female patient. When the number of beats exceeds 120 there is danger of cardiac failure. A weak and rapid pulse is usually developed during the later stages of a dangerous fever; but sometimes the opposite extreme is observed in such cases, and the pulse sinks far below the normal figure. A dicrotic pulse is almost always present in typhoid fever. Irregularity of the pulse is an alarming symptom.

The *urine* is diminished and high colored; it sometimes contains blood and a small quantity of albumin, without indicating any special danger, but when albumin is present in large quantities it indicates serious disorganization of the kidneys. The amount of urea is reduced, but is increased at the commencement of convalescence. Uric acid is increased, excepting in fatal cases. The chlorides and other inorganic constituents of the urine are diminished during the fastigium. The total aggregate of solids contained in the urine is somewhat greater than in health, hence the rapid emaciation of the patient. Numerous imperfectly oxidized products of disintegration appear in the urine, and doubtless serve by their presence in the blood and in the tissues to aggravate the symptoms of the disease.

So numerous and so frequent are the *complications* that accompany the course of typhoid fever that nearly seventy-five per cent. of the mortality from typhoid fever must be ascribed to complicating causes. During the period of invasion copious *bleeding from the nose* indicates a hemorrhagic tendency. Various forms of *sore-throat*, *thrush*, and *gastric disorders* may exist as complications. *Pneumonia* also sometimes coëxists with the early stage of the disease. This is probably dependent upon the coöperation of the two forms of contagion. Occasionally *serous pleurisy* is observed during the early stages of typhoid fever.

During the fastigium *gastro-intestinal inflammation*, *erosion*, *ulceration*, and *perforation* may occur. *Peritonitis* may also develop, either as a consequence of perforation or by reason of an extension of the inflammatory processes from the interior of the stomach and intestines. It is sometimes caused by rupture of the gall-bladder, or by the evacuation of an abscess in the spleen, or elsewhere. *Intestinal hemorrhage* is one of the most common of the abdominal complications belonging to

this period. It is more frequent among females than among males, and is usually observed during the course of the second or third week. Sometimes there is a copious discharge of blood from the anus; in other cases the intestinal canal may be filled with blood without any external evacuation. Slight hemorrhages are not dangerous, and are sometimes followed by amelioration of the symptoms of the fever. *Laryngeal erosions* and *ulcerations* exist in about twenty per cent. of the fatal cases; they frequently escape observation before death, but sometimes they produce laryngeal œdema, perichrondritis, and necrosis of the cartilages. *Catarrhal bronchitis* is almost always present during the fastigium, and is usually overlooked, unless it acquires considerable severity. *Hypostatic pneumonia* commonly exists in severe cases, when the patient lies continually upon the back. *Lobar pneumonia* may occur at any stage of the disease. It is frequently insidious, and progresses without marked symptoms, assuming an adynamic form like that of senile pneumonia. *Pleurisy* rarely occurs. *Cerebral symptoms* are frequently observed, and are largely dependent upon the presence of typhoid bacilli in the brain. Sometimes the symptoms of pneumonia or of acute meningitis are manifested. Occasionally the symptoms assume the form of a low, querulous form of paranoia. Sometimes suicidal impulses exist. In the majority of cases that exhibit symptoms of insanity, a previous predisposition in that direction may be discovered.

During the *period of convalescence* various gastro-intestinal disorders are frequently experienced; these are usually of an inflammatory character, and are dependent upon previous lesions of the *adenoid tissue* along the course of the alimentary canal. Sometimes *jaundice* and *biliary disorders* are produced by the migration of various species of bacteria from the intestine into the biliary passages. An exhausted and anæmic condition of *the brain* frequently persists for a long period of time, and is occasionally followed by permanent mental weakness or derangement. Among children a form of *aphasia* sometimes exists for two or three weeks, and then disappears completely. Various disturbances of the functions of the *peripheral nerves* are sometimes manifested during the period of convalescence; these are generally dependent upon neuritis. *Ulceration* of the *cornea*, which sometimes originates during the course of the fever, may prove intractable, persisting during the period of convalescence, and resulting in complete destruction of the eye. The ear also frequently becomes involved by suppuration that extends along the Eustachian tube from the nose into the middle ear, often producing perforation of the tympanum and loss of hearing. *Caries* of the petrous portion of the *temporal bone* rarely occurs. Degeneration of the *cardiac muscle* produces great weakness of the heart and a feeble circulation of the blood. Sudden death during the course of typhoid fever is frequently dependent upon this cause. It is especially frequent on waking in the morning, if the patient has been left without sufficient nourishment during the night. The *blood-vessels* are frequently attacked by inflammation of their walls. In this way an artery may become obliterated, or a thrombus may obstruct the veins. The *muscles* frequently undergo a special form of degener-

tion, and are sometimes ruptured as a consequence of the weakness that is thus produced. In certain cases the *bones* become the seat of inflammatory action, accompanied by pain and deformity, or by the gradual development of circumscribed periostitis and osteitis. The *joints* also become swelled and painful, as if attacked by rheumatism. Sometimes pyæmic suppuration involves the articulations. During the period of convalescence, various *glandular structures* may be invaded by inflammation. The parotid gland, the thyroid gland, the ovaries, and the testicles are sometimes thus disorganized.

In addition to the lesions above described, the existence of typhoid fever frequently seems to favor the invasion of the organism by various other infective agents, so that pneumonia, erysipelas, diphtheria, gangrene, and other infective diseases, either appear during the course of the fever, or follow its decline. The ordinary *bacterium coli* frequently improves this opportunity to invade the biliary passages and other organs of the body, in which it produces inflammatory symptoms.

The evolution of typhoid fever is subject to many varieties of form, which are probably dependent upon the relative variations of the bacterial contagion in different cases. In the *ambulatory* form of typhoid fever the patient does not feel sufficiently ill to remain in bed; he appears debilitated and pale; complains of headache and of pain in his limbs; his sleep is restless; sometimes there is a mild diarrhœa; the spleen is always enlarged; the pulse is accelerated, and a few rose spots may generally be discovered. Recovery is reached in the course of four or five weeks. These cases, though mild, are not devoid of danger, since ulceration, hemorrhage, and perforation of the intestine may lead to a fatal result.

Abortive forms of the fever sometimes occur. The symptoms develop suddenly in the midst of health. Upon the second day the temperature reaches 103° or 104° F. Gastric symptoms and diarrhœa are prominent; but during the second week there is sudden defervescence, accompanied by copious perspiration, or by an abundant discharge of urine. Sometimes hemorrhage occurs from the nose or from the uterus. Recovery is the rule; but when death occurs from some complication, the characteristic intestinal lesions are discovered.

The *adynamic form* of typhoid fever is characterized by intense prostration. The pulse is weak and exceedingly compressible. The intellect is greatly obscured, diarrhœa is excessive, and hemorrhage frequently occurs. In some cases there is an intense fever, accompanied by violent delirium and hallucinations. *Subsultus tendinum* is commonly observed, and sometimes there are convulsions.

A *hemorrhagic tendency* is not uncommonly associated with the severe and prostrating forms of the fever. Blood may also escape into the subcutaneous areolar tissue, or from any of the mucous membranes of the body.

Typhoid fever may occur at any age, even before birth. When it occurs among young children, delirium is very common. Gastro-intestinal disturbances are accompanied by a painful distention of the abdomen, almost suggessive of peritonitis. The intestinal lesions are less severe than in adults, but the mesenteric ganglia are greatly enlarged.

The disease is sometimes accompanied or followed by paralytic symptoms and aphasia. Other infective diseases may occur as complications.

When typhoid fever attacks elderly people it commences insidiously with a low grade of fever, and a frequent absence of severe abdomina symptoms and rose spots. The characteristic feature of the disease i the great prostration that it produces. Respiratory disorders frequentl occur as complications.

The invasion of the pharynx, larynx, heart, lungs, pleura, an kidneys by an inflammatory process is not unfrequently observed, an is accompanied by the characteristic symptoms of such inflammations.

A *splenic form* of typhoid fever has been observed. It is characte ized by a recurrent type of fever, and by the absence of intestinal di orders. The spleen is sometimes enlarged, and its capsule exhibits th appearances of localized peritonitis. In other cases the spleen is great enlarged by the occurrence of hemorrhage within its substance. Th fever continues for six or seven weeks; then, after an intermission one or two weeks, the fever again recurs. In still another form of th disease the symptoms of ordinary relapsing fever are closely imitate and the disease can only be distinguished by the absence of spiril from the blood.

In certain obscure forms of the fever the symptoms of general sep æmia are manifested during life, but the autopsy reveals the presen of typhoid bacilli in various organs of the body.

The concurrence of pneumonia and typhoid fever has been alrea noted. Scarlatina, variola, and measles may also concur with typh fever. In malarious countries miasmatic contagion and the typh bacillus may simultaneously invade the patient, producing that form fever which has been termed *typho-malarial fever*. In certain ca the typhoid type is predominant, while in others the malarial featu characterise the fever. The symptoms of both diseases are intimat associated; usually the commencement and conclusion of the fever characterised by a malarial physiognomy, while the fastigium prese the more characteristic features of typhoid fever. The lesions of typh are frequently less conspicuous than in uncomplicated cases, and liver exhibits the enlargement and discoloration that are produced malarial infection. Sudden death, intestinal hemorrhage, and perfo tion are not uncommon incidents. Quinine exerts comparatively li influence upon the course of the fever.

A [illegible] form of typhoid fever has been recently described in [illegible] under the name of *ataxic typhoid*. It has also b [illegible] The period of invasion occu [illegible] the patient complains of gen [illegible] by a rapid developm [illegible] a temperature of 1 [illegible] intestinal hemorrh [illegible] first week, though diarrh [illegible] a longer period, and [illegible] always slow, someti [illegible] been observed that

form of fever only occurs among patients who have been previously victimized by malaria.

The *duration* of typhoid fever is closely associated with the severity of its symptoms. The average duration is about twenty-five days, but in severe cases it may continue for a much longer period.

The *mortality* of the disease has always been very considerable. According to Murchison, who founded his statistics upon 27,951 cases, the mortality was 17.45 per cent. Jaccoud found a mortality of 19.23 per cent. among 80,149 cases; but since that date later statistics, which include numerous mild cases that were formerly excluded, and which also exhibit the results of improved methods of treatment, yield a more favorable percentage.

The conclusion of an attack of typhoid fever is sometimes followed by a *relapse*. This usually occurs from four to ten days after apparent recovery, and is characterized by many of the symptoms of the original invasion. In the majority of cases the period of relapse is shorter and less severe than the original attack, but there are exceptions to this rule. The cause of such relapses is supposed to consist in a re-infection of the system by the liberation of bacilli which had been imprisoned within the organs of the body. In this respect the relapse of typhoid fever resembles the corresponding recurrence of relapsing fever. It is supposed that in such cases the elements of the tissues have not acquired that tolerance of the typhoid poison which is usually only reached after a prolonged exposure to its influence. Laboratory experiments indicate that the protection of mice against the contagion of typhoid fever can only be obtained by numerous successive inoculations which exert an influence that is comparable to the effects of acclimatization—that is, a continuous invasion of the system by small quantities of the contagion.

Pathological Anatomy. In each organ of the body the morbid process that underlies typhoid fever is characterized by the intrusion of the specific contagion. Its rapid multiplication and its reaction with the white corpuscles and phagocytic cells of the tissues lead to disturbances of the circulation, degeneration of the parenchyma, and death, or reparative action and final recovery. During these active perversions of normal function, the organism is liable to invasion by other infective agents, by which secondary processes may be set up—*e. g.*, suppurative inflammation, pneumonia, etc. During the process of convalescence the dead and enfeebled cells of the tissues are removed by the agency of phagocytes and other excretory structures, while the surviving tissues proliferate and replace the missing elements, so that in many instances the general health is greatly improved after an attack of typhoid fever. Sometimes, however, the process of repair is imperfect, and connective tissue takes the place of highly organized parenchymatous structures. In this way various structural diseases of the nervous, vascular, renal, and hepatic organs, may be initiated.

It is in the *small intestine* that pathological changes are first developed. The neighborhood of the ileo-cæcal valve is the favorite seat of the morbid processes. During the first week of the fever the mucous membrane becomes infiltrated with typhoid bacilli, and the phenomena

of catarrhal inflammation are developed. The *follicles of Lieberk* and the *patches of Peyer* become swelled and elevated. After sixth day, in severe cases, the patches become still more swelled, in rated, and reddened. The lymphatic vessels are dilated and filled v white corpuscles. Numerous typhoid bacilli may be discovered in c nies, or diffused among the tissue cells. The lymph vessels in deeper portions of the patch contain numerous bacilli, and someti they may be discovered in the walls and in the lumen of the bl vessels themselves. The obstruction of the circulation that is effected soon leads to fatty degeneration of the tissue cells and of leucocytes. In mild cases the process does not advance to ulcera but the products of degeneration are absorbed and removed by the viving cells. In severe cases ulceration occurs about the tent twelfth day of the fever. The degenerated tissues break down and discharged into the intestine. The minute follicular ulcerations exceedingly dangerous on account of their depth and tendency to foration of the intestinal wall. During the third week of the feve necrosed surface of the ulcerated patches is thrown off, leaving a cl granular ulceration, which is slowly repaired by a tardy process of trization. Fortunately, the intestine rarely undergoes constriction result of this process. Sometimes the scar becomes darkly pigme In certain cases the above-mentioned lesions are very insignifican may be wholly absent. This is the case in the early stage of f growth, but in the embryo of seven or eight months, the intestinal cles, the mesenteric glands, and the spleen, have been found in a of disease.

The *mesenteric glands* begin to enlarge at the very commence of the fever; they exhibit a condition of hyperæmia, and become trated with bacilli and phagocytes in a manner very similar to wh observed in the patches of Peyer. During the subsidence of the di the mesenteric glands undergo fatty degeneration of their cellula ments, and sometimes actual suppuration takes place.

In the *adenoid tissues* of the *gastric mucous membrane*, patholo changes occur that closely resemble the corresponding processes i patches of Peyer. The epithelium of the peptic glands undergoes degeneration. Similar changes are observed in the adenoid tissu the pharynx, tonsils, fauces, and base of the tongue.

The *spleen* begins to enlarge during the first week of the fever, by the end of the second week it is frequently two or three time normal size. Sometimes the organ is ruptured by excessive swel Typhoid bacilli are numerous in its substance during the first ha the disease.

The *liver* is rarely increased in size, but its color is pale or a gray. The bile is scanty, thin, and light-colored. A moderate de of fatty degeneration that is proportioned to the intensity of the dis may be observed in the hepatic cells. Numerous bacilli are accumul in the portal vein and in its capillary ramifications. The biliary sages are also invaded by typhoid bacilli and by other microörganis producing, sometimes, catarrhal inflammation, ulceration, or even foration of the gall-bladder.

The *pancreas* and the *salivary glands* are swelled at an early stage of the disease, and their glandular epithelium undergoes granular degeneration.

The *bronchi* exhibit a condition of catarrhal inflammation. All forms of inflammation may occur in the *lungs*. The different forms of *pleurisy* may be also excited by the typhoid bacillus, or by other secondary microörganisms. In like manner the adenoid tissues of the *larynx* are usually invaded, and inflammation, suppuration, and necrosis may subsequently attack the various tissues of the organ.

In the *nervous system*, leucocytic infiltration is frequently observed in the perivascular sheaths, and around the nerve cells which are sometimes loaded with pigment. The process of repair sometimes results in a redundant formation of connective tissue. Multiple sclerosis of the brain or spinal cord may thus find its starting-point in the consequences of typhoid fever. Sometimes neuritis has a similar origin in the inflammatory tendencies of the fever.

The *kidneys* are generally more or less involved. In severe cases bacilli may be discovered in the urine, and a diffuse nephritis is developed. The urine contains albumin and granular or colloid casts. The muscles are dry, and with the aid of a microscope a condition of waxy degeneration may be discovered in some of the fibres, while others exhibit fatty degeneration. A similar condition is often present in the muscular structures of the heart. The nutrient vessels of the organ frequently exhibit a condition of endarteritis, followed by consequent degeneration of the muscular structure, long after the termination of the fever. A similar condition is common in the walls of the bloodvessels in the neighborhood of the intestine and other organs where the specific bacilli are particularly numerous.

The *blood* contains very few bacilli, but its red corpuscles are diminished in number, and their hæmoglobin is greatly reduced in amount. The white blood-corpuscles are increased in number during the early stages of the disease, but at a later period they migrate into the tissues in such numbers that the blood itself contains less than the normal quantity.

The *marrow of the bones* undergoes changes similar to those that are observed in the spleen. The presence of typhoid bacilli sometimes causes circumscribed inflammations and necrosis that may persist for a long time after the conclusion of the fever. Occasionally the joints undergo corresponding changes.

Furuncles and subcutaneous *abscesses* are not uncommon during the period of convalescence. The bacilli may be discovered in the pus of such abscesses for many months after the fever. Sometimes *gangrene* occurs as a result of vascular inflammation and obstruction. The *parotid glands* and the *testicles* are sometimes inflamed, and may undergo suppuration.

Etiology. *Typhoid fever* was formerly ascribed to the introduction of putrid substances into the blood. By certain pathologists it was supposed to be the consequence of auto-infection with morbid products of tissue change that were accumulated within the organism. In 1880, Eberth described the *bacillus typhosus* and announced its causative

relation to the phenomena of typhoid fever. The bacillus whi discovered varies in its form, according to the character of the m in which it grows and multiplies. It is from one-quarter to one- of the diameter of the red blood-corpuscle, and its transverse dia is about one-third of its length (Fig. 76). It presents near its c portion, a clear space which is suppos indicate a partial degeneration of its stance. The organism exhibits a pow motion that is dependent upon the exis of vibratile cilia. It may be easily culti in broth, milk, urine, gelatin, potatoes other media of the laboratory. It c made to flourish in a vacuum, or in an a phere of hydrogen. So readily does it itself to variable conditions and localitie its universal prevalence and persistenc easily explained. It is still an open qu whether the bacillus produces spores, or whether the minute s which have been considered as spores are anything more than a m degenerated protoplasm, similar to what forms the clear space i middle portion of the bacillus.

Fig. 76.



Typhoid bacilli with spores. (Hallopeau.)

The typhoid bacillus is capable of supporting for a brief period a perature of 194° F., but if exposed to moist heat at a temperat 140° F. for twenty minutes, its vitality is destroyed.

Enclosed in a block of ice at a temperature considerably belo freezing-point, the microörganism remains alive for many month if the water in which it is contained is alternately frozen and t five times a day, the bacillus is completely destroyed within days.

The chemical rays of solar light rapidly destroy the vitality typhoid bacillus. The organism flourishes best in the absence o light.

It has been shown that the action of the gastric juice upo typhoid bacillus depends upon the presence of hydrochloric acid. normal degree of acidity is insufficient to destroy the bacillus, t its vigor and power of proliferation are somewhat diminished. aqueous solution of hydrochloric acid that is three times as stro ordinary gastric juice, the bacilli are destroyed only after the exp of three hours. Hence it is apparent that under ordinary con the fluids of the stomach are incapable of protecting the org against the invasion of typhoid contagion.

From old cultures of the typhoid bacillus has been extrac ptomaïne to which has been given the name typho-toxine. This ever, does not represent all of the poisonous products of the ba It has been shown that the soluble products of the microbe st gelatin upon which it has been cultivated, so that fresh crops bacillus can no longer be propagated upon that soil. It has also shown that these soluble products when injected into the bodies o produce immunity against the disease. It is probable that the the same effect upon the tissues of human beings. The investigat

these toxalbumins will doubtless be attended with much that is interesting in the matter of pathology and prophylaxis.

Examination of the bodies of patients who have died of typhoid fever indicates the almost uniform presence of the typhoid bacillus in the liver, spleen, mesenteric glands, and patches of Peyer. It is found less frequently in the other organs of the body, and very rarely in the blood. Its presence in the different organs is supposed to explain various local phenomena of the disease. When the fever has run through a long course before the death of the patient, other microorganisms that somewhat resemble the typhoid bacillus are frequently found in the tissues. Sometimes they may be identified with the ordinary *bacterium coli*, but they often resemble common modifications of the genuine typhoid bacillus.

During life the bacillus is rarely found in the blood. It must be sought in the organs of the body. It may, however, be found in the rose spots at the time of their eruption. It has been asserted that these papillary phenomena are due to embolic obstruction by the accumulation of bacilli in certain vascular tufts within the skin. The microbe can be readily discovered in the feces, in the urine, and in the sputa from the lungs. After the termination of typhoid fever the bacilli sometimes remain for a long time in certain portions of the body, and preserve their vitality for many months. Under such circumstances the microörganism appears to assume pyogenic virulence. It is present in the abscesses and other suppurative lesions that sometimes follow the course of the fever.

The lower animals do not become spontaneously infected with the contagion of typhoid fever. Many experiments have shown the impossibility of exciting the disease by feeding them with the discharges of typhoid patients, but it has been recently shown that by the injection of virulent cultures into the duodenum or into the peritoneal cavity of guinea-pigs and white mice, it is possible to produce symptoms of fever, diarrhœa, swelling of the patches of Peyer, mesenteric glands, and spleen, followed by the death of the animal, and the discovery of the specific bacilli in its tissues. It has also been ascertained that if the virus be attenuated by its culture at a temperature of 107°–113° F., a fatal result rarely occurs; and by inoculating white mice with the soluble products of bacterial growth, they may be protected against infection with virulent cultures.

The contagion of typhoid fever is principally diffused through the medium of fecal matter. It is also contained in albuminous urine, and in the blood of intestinal hemorrhages from typhoid patients. It is sometimes found in the sputa and in pus that is formed in abscesses after the fever. The bacillus is most abundant in the intestinal discharges during the period of ulceration, especially between the tenth and seventeenth days of the fever. In ordinary cases the specific microörganism cannot be found after the twenty-second day, unless relapses of the fever are experienced.

After the discharge of typhoid feces the specific microbe remains alive and virulent for a considerable period of time. Desiccation does not destroy its vitality; consequently dried feces form an excellent

vehicle by which it may be mingled with the dust and diffused throu the atmosphere, finding its way into open reservoirs of water, a washed by the rain into the interstices of the soil. Clothing that h been soiled may become a means of conveying contagion, and it m lie dormant in the dust and dirt of a deserted habitation for months years. In the accumulations of privies, the germs of fever may p serve their vitality for an indefinite period, exercising no deleteri effect upon the neighborhood until they are liberated by the agitation which the fecal mass is subjected when the privy vault is emptied. this way the atmosphere over a vault may become charged with vi lent microbes, exciting fever where it had been for a considerable ti unknown.

The contagion of typhoid fever is very frequently transmitted throu the medium of drinking-water. Many cases are recorded in which t contamination of a particular well or rivulet has been followed b formidable outbreak of fever among the people who drew their wa supply from that particular well or stream. Sometimes the water sou becomes contaminated by the filtration of rain-water from some du hill which had been made the receptacle for typhoid discharges. T deposit of manure that has been mixed with typhoid feces upon fie from which the subterranean water is collected for the supply of dri ing water, is followed by no deleterious results until the expiration o month after the first rainfall; the typhoid microbes sink with the r into the soil, and find their way with the subterranean water into t wells and reservoirs which derive their supply from that particu locality. In this way the occurrence of typhoid fever may sometim appear to be dependent upon meteorological causes.

Laboratory experiments have shown that typhoid bacilli, when mi with healthy feces, preserve their vitality at ordinary temperatu provided the fecal matter be kept slightly alkaline. In acid media t bacilli are destroyed in two or three days, but they remain active three or four months when mixed with comparatively solid fecal matt From these experiments it is evident that the specific microbe of typh fever cannot be easily destroyed by the ordinary conditions to whic is exposed. In privy vaults, dunghills, dust, and soil, it undoubte preserves its vitality for a period that is much greater than any that been measured under the artificial circumstances of laboratory cult

The determination of the presence of typhoid bacilli in drinki water is not always easy, since ordinary water is not a favorable medi for their growth. Under such circumstances their form and virule may undergo considerable modification, and the ordinary bacteria t vegetate in water appear to exercise an unfavorable influence upon t development. A number of bacterial organisms exist in water wh closely resemble the typhoid bacillus, but careful observation of form, mode of motion, and culture of these different organisms suff to determine their nature. It has been shown that when typh bacilli are introduced into impure water that swarms with ordin bacteria, their number is rapidly diminished during the first twenty d but that after that time the few survivors remain apparently accli tized and capable of rapidly propagating the species when introdu

into more favorable media. This very considerable reduction of numbers might easily lead an incautious observer to infer their entire disappearance.

Though it is true that the typhoid bacillus cannot easily maintain itself in moving water, it finds a congenial habitat in the mud that accumulates in reservoirs and flowing streams. When contaminated water is placed in a bottle that contains a small quantity of mud, the bacilli disappear from the water after the expiration of two months, but they still remain numerous and vigorous in the deposit at the bottom of the flask.

It has been claimed by many observers that the use of foul water favors the invasion of the body by the contagion which otherwise would have been successfully resisted by the organism. While this hypothesis is not without a certain degree of plausibility, no facts are yet recorded for its demonstration. There is no evidence to show that typhoid bacilli can penetrate the tissues and there remain latent until wakened to activity by irrigation with dirty water. All the facts of observation indicate that whatever may be said against the use of impure water, typhoid fever will never be excited by its action alone.

Milk has been frequently accused of transporting the contagion of typhoid fever. Obviously it is possible for the liquid to be contaminated with dust or other impurities that contain the desiccated germs of the disease. But in the majority of cases it has been shown that milk has been rendered deleterious by mixture with water from a well or other source that contains the specific bacilli. In this way vegetables may be sometimes contaminated by immersion in unhealthy water. Lettuce, celery, and other greens that have been sprinkled with water from a contaminated source might thus convey the contagion of the disease. It is certain that the majority of articles that are used as food afford excellent media for the cultivation of the typhoid bacillus.

It is very doubtful whether typhoid contagion can enter the human body through abrasions or wounds upon the cutaneous surface. The infective bacilli may find their way through the delicate membranes that line the air-cells of the lungs, but in the majority of cases the port of entry is through the mucous membrane of the intestinal canal. Not only do the facts that have been observed regarding the effects of unwholesome drinking-water, but also the condition of the intestinal mucous membrane, crowded with masses of bacilli at the commencement of the disease, serve to establish this conclusion.

The typhoid bacillus may be transported by the air, but it is almost impossible for it to be inspired in quantity sufficient to produce infection; it is, however, probable that bacilli thus transported into the mouth and pharynx may be swallowed, and may thus reach the intestine, where they readily multiply.

The typhoid bacillus can be conveyed through the blood of the mother into the body of the fœtus. It has often been found in the liver and spleen of the aborted embryo. The fœtus sometimes preserves its vitality, and is not thrown off when the mother suffers from an attack of typhoid fever. It is probable that in such cases immunity is acquired by the offspring.

Typhoid fever is most frequently experienced in youth and early adult life. It seldom occurs after the fortieth year; about one-fourth of the fatal cases occur between the twentieth and twenty-fifth years of life. The disease is more frequent among men than among women, but its fatality is greater among the female sex. Recent immigrants into an infected locality are more susceptible than those who have become acclimatized by long residence; hence it is more commonly observed among young country people who flock into the large cities in search of employment.

The occurrence of typhoid fever is favored by those conditions of life and by those occupations that occasion fatigue, insufficient or unwholesome alimentation, and a general depression of vitality. Exposure to cold, pregnancy, and slight departures from the normal condition of health operate as predisposing causes of the disease. Laboratory experiments have shown that fowls which have been inoculated with the virus of chicken-cholera do not succumb to the disease unless they are chilled by prolonged immersion in cold water. Refrigeration favors the development of the virus, and the symptoms of cholera soon appear. It has also been shown that when pigeons are inoculated with the virus of anthrax, they do not become infected unless deprived of sufficient food. In this way it is easy to explain the manner in which cold and hunger favor the propagation and development of various infective diseases.

Prognosis. No case of typhoid fever can exist without danger to the patient. The disease is always dangerous among elderly people, among the victims of obesity, alcohol, and physical exhaustion of every description. During pregnancy it is dangerous, both in itself, and by reason of the tendency to abortion. The perils of the disease are greatly increased by every form of cardiac and vascular weakness and disorder. It is more dangerous to women than to men, especially when they suffer from chlorosis and congenital imperfections of the vascular organs. Neurotic patients constitute unfavorable subjects for the fever, since they are predisposed to cerebral and nervous disorders which develop during the course of the disease, and may persist after its convalescence. All forms of unusual nervous depression and disorder afford an unfavorable basis for the prognosis. Excessive temperature, and a sudden defervescence that is not determined by hemorrhage or by therapeutic measures, are most alarming symptoms. When the course of the fever is marked by considerable oscillations of temperature, the prognosis is more favorable than it is when the temperature is continuously and uniformly elevated. The persistence of the fever beyond the end of the third week is an unfavorable symptom when it cannot be ascribed to a relapse. Secondary infections also increase the gravity of the situation. A pulse that exceeds 120 beats, especially if it be feeble and irregular, indicates great danger. Recovery is almost unknown if the number of beats reach 150 per minute. A slow pulse is no sign of amelioration, since it is usually excited by great nervous prostration, by myocarditis, or by intestinal hemorrhage. Copious discharge of urine is usually a favorable symptom.

Diagnosis. *Typical* cases of typhoid fever can be easily recognized

their symptoms are fully developed. *Abortive* forms of the fever ith difficulty distinguished from *gastro-intestinal disturbances* that accompanied by a febrile movement; these, however, are usually mpanied by vomiting, diarrhœa, and colic. The spleen does not me enlarged, nor does the fever continue longer than a week or days.

Typhus fever is distinguished by its rapid onset, and by the char- r of the eruption, which is livid, and does not disappear on ssure.

The typhoid condition which sometimes accompanies *severe forms remittent fever* cannot be easily distinguished from *typho-malarial* er, except by microscopical examination of the blood for the hæma- zoon of malaria. The stools should also be examined, in order to termine the absence of typhoid bacilli which are present in the mixed rm of the disease.

The fever that accompanies the *secondary stage of syphilis* appears multaneously with the roseolous eruption, instead of preceding it by week.

Herpetic fever sometimes may be mistaken for typhoid fever until e appearance of the characteristic eruption enlightens the diagnosis. *nflammations of the kidneys* that are accompanied by fever can be stinguished from typhoid fever by the thermometric curve, by the bsence of rose spots, enlargement of the spleen, and diarrhœa.

In obscure and irregular forms of fever the diagnosis is sometimes mpossible unless aided by the discovery of typhoid bacilli.

Those forms of *pneumonia accompanied by delirium or stupor* may e differentiated from real typhoid fever by physical examination of the ngs. When typhoid fever actually coexists with pneumonia, the fact n only be determined by the persistence of its characteristic symptoms ter the subsidence of pulmonary inflammation.

When *pleurisy* co-exists with typhoid fever, it presents its ordinary enomena, but the combined disease is characterized by unusual inten- y of fever, with great prostration, headache, and wakefulness. The ver is continued, and does not present the remissions that characterize ere forms of tubercular pleurisy. Among nervous women the inva- n of typhoid fever is sometimes characterized by all the symptoms of *ercular meningitis.* In such cases, however, ophthalmoscopic exami- ion discovers no tubercles in the choroid; and after a few days the racteristic differences between the two forms of fever become appa- t. Similar confusion is not uncommon in the case of children when cked with typhoid fever. When meningitis occurs as a complica- , it is often difficult to differentiate it from tubercular meningitis if re be no diarrhœa or rose spots apparent.

Acute miliary tuberculosis frequently resembles typhoid fever when ompanied by diarrhœa and by roseola. But the oscillations of tem- ature are more irregular, and there is a greater degree of dyspnœa. e discovery of tubercular bacilli in the sputa is a decisive event.

Cerebro-spinal meningitis is accompanied by intense headache and in in the spine. The head is drawn backward, diarrhœa is usually sent, the tongue remains moist, and rose spots do not appear.

Ulcerative endocarditis can only be differentiated by careful exa nation of the heart, and by the discovery of embolic symptoms.

Influenza sometimes resembles typhoid fever, but its rapid cou and the predominance of bronchial symptoms serve to distinguish t disease.

Trichinosis closely resembles typhoid fever during its acute stag but it may be differentiated by the existence of intense pain and te derness in the muscles, and by the occurrence of œdema about the fa and eyelids.

The *acute form of glanders* may be, in certain stages of the disea mistaken for typhoid fever.

Septic inflammations are often accompanied by symptoms th resemble typhoid fever, but the remittent character of the febri movement, and the development of abscesses serve as differential ind cations.

In like manner *acute infective osteo-myelitis* can be readily mistak for typhoid fever, if the osseous lesions are overlooked.

Acute mania presents delirious symptoms which sometimes lead confusion with the delirium of typhoid fever, but the mental derang ment is unaccompanied by the febrile movement and other symptoi that characterize the typhoid disease.

PROPHYLAXIS. The most important prophylactic measure agai the propagation of typhoid fever consists in the sufficient supply of pu drinking-water for public use. Next to this must be considered t suppression of privy vaults, and the substitution of a method by whi fecal matters can be completely and immediately removed from t vicinity of every habitation. If pure drinking-water cannot be obtaine the supply should be sterilized by boiling, or by filtration through u glazed porcelain, or fine-grained stone. Apartments that have be occupied by typhoid fever patients should be disinfected by washing the wood-work with a 1 : 1000 solution of corrosive sublimate; aft this disinfection it should be repainted, and the walls should be whi washed. Bedding and clothing, carpets, and other draperies shou be exposed to hot air in a disinfecting stove constructed for the pu pose. When typhoid fever attacks a regiment, or other body of m that can be mobilized, their transportation to an uninfected locality the best means of arresting the progress of the epidemic.

The care of typhoid patients demands the greatest attention to p sonal cleanliness on the part of the sufferer and his attendants. F quent sponging with warm water and soap, and the use of a 1 : 1(solution of corrosive sublimate as a disinfectant for the hands, greatly reduce the dangers of infection. Soiled clothing should placed in a basin or tub of water until it can be subjected to a boil temperature for at least half an hour. All the excreta of the patien sputa, feces, urine, etc.—should be sterilized as soon as voided by addition of ordinary milk of lime, containing 20 per cent. of hydra calcium. Of this liquid, two parts by measure are sufficient to steri one hundred parts of typhoid excreta, and its action is much more en getic and prompt than that of other more costly and dangerous dis fectants.

TREATMENT. Since typhoid fever is caused by the invasion of the body by a parasitic contagion, and by the intoxication of the tissues with poisons that are produced through the activity of this parasite, a genuine curative treatment should consist either in the destruction of the contagion, or in the fortification of the tissues against the products of its growth. Since, however, we at present possess nothing capable of fulfilling these indications, it becomes necessary to proceed indirectly against the effects of the disease. Various methods have been adopted in past times with the hope of combating the fever, but the majority of these processes now possess only an historical interest. It becomes necessary either to adopt an expectant method, which consists in allowing the patient to drift, aided only by inert medication and by more or less judicious nursing, or to resort to measures which consist chiefly in the employment of baths for the reduction of temperature, and the cautious supply of food in such form as will best promote nutrition in an enfeebled subject. Two principal methods for the application of these measures are in vogue: the method of Bouchard, which finds favor in Paris, and the method of Brand, which is universally employed by the Germans. According to the Parisian system, the patient is bathed eight times each day; the bath in which he is placed must be about 3° lower than the rectal temperature; the water is then gradually cooled down to a temperature of 86° F. In this way the body is refrigerated without any disagreeable shock to the system. Every third day the patient receives half an ounce of sulphate of magnesia. During the first four days of the treatment seven grains of calomel are given each day, in divided doses. During the period of intestinal disorder a drachm of naphthol and half a drachm of the salicylate of bismuth are given in divided doses; and every morning and evening the bowels are washed out with warm water containing naphthol. Quinine is also administered when the temperature cannot be reduced by the baths. During the first two weeks it should be given in doses of thirty grains; during the third week the dose may be reduced to twenty grains; and during the fourth and fifth weeks it need not exceed fifteen grains. These doses should be repeated only after intervals of three days, if the temperature reaches a great elevation. The diet must consist of broths, gruels, and lemonade. If delirium be excessive, opiates may be administered.

The method of Brand consists in the application of cold, chiefly through the employment of baths, and in the careful nourishment of the patient. By the early employment of these measures the intestinal lesions are largely prevented, and the consequences of general infection are reduced to a minimum. For the complete success of the treatment it must be inaugurated at the commencement of the fever, so as to anticipate the consequences of general infection. The only contra-indications to the cold-water treatment are derived from the condition of the heart, and from the occurrence of intestinal perforation or peritonitis. Weak and diseased hearts require the method of Bouchard, which is also preferable in cases of old persons, or very young children. The occurrence of pneumonia at an advanced period of the disease, and other conditions indicated by exhaustion and a tendency to syncope,

which usually present themselves during the later stages of the fever, render the method of gradual refrigeration preferable to sudden immersion in the cold bath of Brand.

It has been shown that repeated refrigerations are followed by progressively increasing intervals during which the temperature remains depressed, consequently an early commencement and frequent repetition of cold baths prevents the development of a high temperature as the fever rises toward its fastigium. For the successful employment of baths a sufficient number of attendants is indispensable; the tub should be placed upon wheels so that it can be readily conveyed to the bedside. The temperature of the water should be 68° F., and its quantity must be sufficient to cover the patient to the chin as he lies extended in the tub; the duration of the bath should be from ten to fifteen minutes, and it should be repeated whenever the rectal temperature rises above 103°. It is advisable to sponge the face and chest with cold water before entering the bath, in order to prevent the disagreeable sensation that might otherwise be caused by sudden immersion. While lying in the bath, the head should be wrapped in a towel, upon which cold water may be poured for two or three minutes at the commencement, during the middle, and at the close of the immersion. The surface of the body and of the extremities should be thoroughly rubbed with the hand during the whole period of the bath. As soon as shivering commences the patient should be removed from the water, wiped dry, and placed in bed. A bag of warm water may be placed at the feet, and at the end of half an hour a cup of beef-tea, broth, milk, gruel, or coffee, may be given before the commencement of the quiet sleep that usually follows each bath. If the temperature be not sufficiently depressed, and the patient remains restless and burning with fever, cold compresses or a coil through which cold water continually circulates, should be applied over the abdomen. In severe cases characterized by an extraordinary temperature, the bath may be cooled down to 60° F., and the patient may be allowed to shiver considerably before he is removed from the water. It may be necessary sometimes to renew the baths every two hours.

During the subsidence of the fever the patient should be bathed less frequently, but this method of treatment should not be abruptly terminated. A cold bath at night is exceedingly grateful so long as the temperature continues to rise during the latter part of the day.

During the height of the fever the diet should consist of liquids administered after each bath. When the fever begins to subside, soup may take the place of beef-tea. Thin chocolate, a little wine, and three or four soft-boiled eggs may be allowed each day. Milk is always useful when it can be digested, but the appearance of white particles of curd in the stools indicates that it is being given in excess.

During the period of convalescence the diet list may be gradually enlarged, but with caution, since the feeble state of the digestive organs renders it impossible to dispose of anything but the most easily digested articles of food. A small quantity of the breast of chicken, broiled fish, calves' brains, game, and tenderloin steaks, may be allowed in moderation. Fat meat cannot be digested. After the

temperature has ceased to rise for three or four days, bread and vegetables may be allowed.

During the course of the fever cold drinks may be given in abundance; the patient may be allowed his choice among them all. When there is considerable prostration, strong wine or whiskey may be used with great advantage.

The utmost cleanliness must be preserved about the patient and his bedding. Free ventilation of the apartment is necessary. Clothing and the excretions of the body should be disinfected in the manner previously described. The mouth and throat must be carefully cleansed several times a day with a weak solution of permanganate of potassium.

When typhoid fever attacks elderly people the prognosis is exceedingly grave, since above the age of forty-five the mortality is not less than 40 per cent. Such patients do not support cold baths, but must be treated with warm baths gradually refrigerated. The same treatment should be preferred whenever there is a tendency to collapse and an abnormal depression of temperature. Alcoholic stimulants are then useful.

Thoracic complications that are not attended by symptoms of heart failure may be subjected to the cold bath. Opiates may also be given in small doses to such patients for the relief of harassing cough. Excessive diarrhœa may be frequently relieved by rectal injections containing thirty drops of laudanum. Excessive distention of the abdomen is best relieved by cold external applications, and by the internal use of antiseptics, according to the method of Bouchard. Cardiac weakness is relieved by frequent warm baths, accompanied by friction of the skin and the administration of cardiac stimulants.

Intestinal hemorrhage during the first week of the fever is an indication for cold bathing, but when it occurs during the later stages of the fever, the bath must be forbidden. Cold applications should then be applied over the abdomen, and the diet should be restricted to cold milk or iced beef-tea. In cases of dangerous and alarming hemorrhage great benefit is often derived from the hypodermic injection of a sterilized solution of chloride of sodium in distilled water (7 : 1000). The symptoms of perforation and of peritonitis call for perfect repose, maintained by cold applications to the abdomen, and large doses of opium by the mouth, or morphine hypodermically.

In all cases of typhoid fever it is desirable to promote the action of the kidneys, in order to remove as completely as possible the products of disintegration of tissue and the soluble poisons that are produced by bacterial evolution. For this reason antipyrine is objectionable, since it hinders the processes of elimination.

The adoption of the methods of treatment described above have resulted in a remarkable reduction of the mortality from typhoid fever. Formerly the mortality in European hospitals reached 25 per cent., but the method of Bouchard has reduced that mortality in the hospitals of Paris to 10 per cent.; and by the method of Brand in private practice it is reduced to 2 per cent.; in civil hospitals it stands at 6.7 per cent., while in military hospitals it hovers between 9 and 10 per cent.,

and even under the unfavorable circumstances of actual warfare it d not exceed 11.4 per cent.

From the foregoing description it is evident that the treatment typhoid fever by the hydropathic method is attended with great lab It is consequently most efficient in hospitals, where sufficient attenda and nursing can be obtained. In private practice it is, in the major of cases, impossible to secure the efficient application of such measu The treatment with cold water must also be commenced early in course of the disease in order to accomplish the most beneficial resu Elderly people, very young children, and very delicately organi patients cannot be subjected to such energetic measures as are indica for young and vigorous adults. For these reasons the full adoption the complete hydropathic method is often impracticable. In ma cases, however, warm baths, gradually cooled down to 70° F., can administered at intervals during the day. And if the patient can be treated to the full bath, much benefit may be derived from frequ sponging of the body, and from the application of cold cloths over abdomen. If possible, the use of coils, through which cold water made to circulate, should be encouraged, and in every practicable w the attempt should be made to diminish the temperature by exter refrigerant applications. Antipyrine and other powerful febrif remedies should be used with caution, never longer than two or th days at a time, since they hinder the processes of elimination a retard the course of defervescence. Complications must be met w appropriate measures as they present themselves. In all cases t cannot be subjected to hydropathic treatment, judicious nursing, liq food, consisting chiefly of gruel, broth, and milk, should form the ba of treatment. A mild mercurial course is appropriate during the ea days of the fever; calomel in small doses, or mercury and chalk, m be given for two or three days; naphthol or naphthaline, in five gr doses every four hours, if there be fermentation and gaseous distent of the intestines; salicylate of bismuth, in ten grain doses every f hours, is also useful when the diarrhœa is excessive. Frequent sto indicative of irritation in the lower bowel, may be moderated b rectal injection containing twenty drops of laudanum conveyed thro a rectal tube to a considerable distance above the internal sphinc During the earliest stage of the fever, when there is great heat thirst, cold drinks and effervescing powders are often very gratefu the patient, but they should not be urged if there be manifested a inclination to their use. Cold tea and cold water slightly acidul are often more agreeable than any other beverage. Ten drops of di phosphoric acid in a wineglass of cold water may be administe every three or four hours. Restlessness and wakefulness at ni especially when they occur during the later course of the fever, for an increased amount of nourishment and stimulants. If thes insufficient, sleep may be frequently procured by the administratio thirty grains of sulphonal; antipyrine often affords a similar good re with children; opiates and chloral should generally be avoided account of their depressing influence upon the heart. When it beco necessary to administer opiates, alcoholic stimulants, beef-tea, and

nog should also be given, since death sometimes occurs from heart failure, intensified by opiates if administered without cardiac stimulants. Whenever the heart exhibits signs of weakness, indicated by a rapid and compressible pulse, strychnine should be administered in doses of $\frac{1}{30}$ of a grain every three or four hours. Caffeine, one grain every two or three hours; camphor, one grain every two hours; or musk, one grain every two or three hours, will be found useful in such cases. Severe inflammation of the stomach and small intestine, indicated by a dry, red tongue, is frequently benefited by the administration of nitrate of silver (argent. nitrat., pulv. opii, āā gr. $\frac{1}{4}$ every six hours). If these symptoms are associated with considerable meteorism, oil of turpentine, in doses of five or ten drops in an emulsion, may be administered every two hours, and turpentine liniment should be applied over the abdominal surface. Care should be taken to withdraw the remedy if any symptoms of vesical irritation appear, and it should not be administered if the urine contains albumin or blood. In malarial localities, quinine may be administered during the first three or four days of the fever, and during the period of convalescence, but it is of little use during the fastigium, except as a means of depressing the temperature by the occasional administration of fifteen grain doses, if other more agreeable remedies seem to be contraindicated.

CHAPTER VIII.

INFLUENZA—GRIPPE.

Influenza is an epidemic, infective, catarrhal fever, characterized by intensity of the catarrhal symptoms, by great prostration of the nervous system, and by a tardy convalescence that is sometimes accompanied by serious nervous disorders. It differs from ordinary catarrhal fevers and coryzas by its greater severity and liability to complications, by its pandemic diffusion, and by its dependence upon a transmissible cause.

Symptoms. The course of influenza is marked by three stages: 1. The stage of invasion. 2. The catarrhal stage. 3. Decline and convalescence. The period of *incubation* is of exceedingly variable duration, lasting from a few hours only to a number of days or weeks.

The period of *invasion* is marked by a feeling of general uneasiness followed by a chill of greater or less severity, loss of appetite, nausea, great nervous prostration, exhaustion, supra-orbital headache, and pain in the spinal region. These symptoms resemble the initial symptoms of many acute diseases. The characteristic feature of the period of invasion is intense prostration, out of all proportion with the severity of the actual symptoms. Sometimes there is epistaxis and a general condition of congestion of the mucous membranes. Sometimes the period of invasion appears to be absent. It is usually very brief, rarely continuing longer than a single day.

Catarrhal period. The full development of influenza is characteri by violent coryza involving the maxillary and frontal sinuses, lachrymal ducts, and the ocular conjunctivæ. Extending downw it speedily involves the Eustachian tube, the pharynx, the larynx, trachea, the bronchi, and the gastro-intestinal mucous membra Headache continues with a sensation of tension and fulness about vertex. The nervous system becomes more profoundly affected. this fact lies one of the principal marks of difference between influe and ordinary catarrhal fevers. There is a feeling of præcordial tress, muscular tremor, vertigo, and disturbance of the special sen such as transient impairment of vision, tinnitus aurium, and someti earache; the senses of taste and smell are, of course, diminished by coryzal condition of the mucous surfaces. Sometimes there is an altation of cutaneous sensibility, with severe neuralgia and artic pains like those of rheumatism. Sleep is uneasy and imperfect; th may be mild delirium, and there is great depression of spirits. countenance of the patient exhibits an appearance of suffering intellectual dulness, like that of a person who has experienced a tracted illness.

The *febrile movement* is marked by great irregularity; fever is so times absent; generally, however, it assumes a remittent type, evening exacerbations; but may be distinctly intermittent, resembl a quotidian or a double tertian fever. Sometimes there are numer exacerbations during the course of the day. Sometimes the temp ture is higher in the morning than in the evening. It rarely rea the height that is common in typhoid fever. Usually it varies betw 100° and 102° F., occasionally reaching 104° or 105°.

Incessant *laryngeal irritation* provokes frequent paroxysms of cou by which the headache is greatly increased. As the disease progre expectoration is established, and the sputa may be occasionally strea with blood. *Respiration* is at first slightly accelerated, and is so times associated with evidences of laryngeal inflammation. As catarrhal inflammation invades the bronchi, the râles of *bronc* become audible throughout the chest. Unless complicated by p monia, the percussion note remains normal.

The *tongue* becomes invested with a thick, yellowish fur; the m is pasty; everything tastes badly; thirst is excessive; appetite is l ing; there is nausea, and sometimes vomiting of mucus or of bil matters. Pressure upon the epigastric region produces pain, and t is a feeling of tension and pain in the hypochondriac regions. some cases there is intestinal colic followed by diarrhœa, in which passages contain mucus, bile, and occasionally blood. Not unfreque however, the early stage of the disease is characterized by obstinate stipation that aggravates the headache.

In many cases the course of the disease is marked by the pred nance of symptoms involving certain organs of the body. Three cipal forms of influenza thus become prominent:

1. The *encephalic form*, characterized by an exaggeration of ordinary nervous phenomena of the disease. In such cases the co symptoms are excessive, and the ordinary headache may be accompa

by intense neuralgia, delirium, convulsions, or even apoplectiform attacks. The mind sometimes becomes alienated, and the patient may exhibit the symptoms of insanity, sometimes characterized by a suicidal tendency. Among children there is a tendency to coma, which among old people may be accompanied by paralysis and apoplectiform phenomena.

2. In the *thoracic form* of influenza the mucous membranes of the respiratory passages are the seat of the most prominent symptoms. The inflammation is catarrhal in its character; pneumonia, pleurisy, and cardiac or pericardial inflammations must be regarded as complications when they occur.

3. The *abdominal form* of influenza is less frequent than the other forms of the disease; yet in certain epidemics it is frequently observed. In this form the respiratory organs may present little, if any, evidence of disease, while gastro-intestinal inflammation may be exceedingly severe. The general symptoms of this variety closely resemble those that are furnished by ordinary gastro-intestinal inflammation, but they are attended by a greater degree of exhaustion and nervous prostration than is observed in ordinary enteritis. The severity of the abdominal symptoms and their epidemic course has not unfrequently suggested reminiscences of dysentery and cholera; hence the term "winter cholera" that has been sometimes applied to this form of influenza when prevalent during the winter months of the year.

In certain epidemics the intestinal disorders are accompanied by such a degree of fever, delirium, insomnia, and nervous disturbance that they strongly resemble the course of typhoid fever.

In many cases typhoid fever seems to follow influenza so closely that the initial disease becomes merged insensibly in the other, which then completes its ordinary course.

Complications. Pneumonia forms one of the most dangerous complications of influenza. Its course is slow and insidious, commencing during the height of the original disease, or during its period of decline and convalescence. It is ushered in by a slight chill, dyspnœa, increasing cough, and sanguinolent expectoration. Unless intercostal neuralgia and pleurisy are present, it is unaccompanied by pain; but there is a greater degree of dyspnœa than the amount of inflammation would justify. The character of the expectoration is less opaque and tenacious than that of ordinary pneumonia. There is nearly always dulness on percussion, but the auscultatory signs are less characteristic. Instead of the fine crepitant râle succeeded by tubular respiration, during the first and second stages of ordinary pneumonia, there may be entire absence of respiratory sounds, or only a few moist, sub-crepitant râles. The tongue is not red and dry, as in ordinary pneumonia, but is broad, thick, and covered with a moist and yellowish fur. There is often considerable delirium at night.

In certain cases of influenza there is a marked tendency to hemorrhage from any or all of the cavities of the body. Various eruptions have been observed in certain cases; these are erythematous, or they resemble the rashes of measles and scarlet fever. Sudamina are sometimes observed, and herpetic eruptions are not uncommon. Diffuse

periostitis has occasionally been observed as a complication of influenza, as it sometimes occurs in other infective fevers. Cardiac diseases are greatly exaggerated, and are sometimes originated during the occurrence of influenza. Acute phthisis sometimes develops in the course of the disease.

Period of decline and *convalescence.* The duration of influenza is exceedingly variable. It sometimes may subside at the end of two or three days, or it may continue for two or three weeks, or even longer, in complicated cases. Generally, the older the patient the longer the duration of the disease, but its course and intensity are often different in different epidemics. The decline of the disease is often marked by a gradual subsidence of the symptoms; but sometimes it terminates abruptly with some form of critical discharge from the body. Sometimes a hemorrhage or a cutaneous eruption may occur instead of a critical perspiration, diarrhœa, or discharge of urine. A fatal termination is generally caused by pneumonia.

The *period of convalescence* after influenza is exceedingly prolonged; there is frequently a persistent cough, general prostration, great sensitiveness to variations of temperature, loss of appetite, and excessive fatigue after slight exertion. Relapses are, perhaps, of more frequent occurrence than after any other disease.

Among the *secondary diseases* that are likely to follow influenza are disorders of the nervous system, and catarrhal diseases. Among the nervous affections thus induced may be mentioned vertigo, functional disorders of vision and of hearing, disorders of taste and of smell, disturbance of the general sensibility, and, sometimes, intellectual derangement. Certain cardiac disorders of a nervous character, such as palpitation, syncope, cardialgia, and cardiac debility, are often observed.

The catarrhal diseases of the respiratory organs often become chronic after influenza, and latent tendencies to tuberculosis become quickened and established. In fact, the disease seems to prepare the way for invasion of all the organs of the body by the tubercle bacillus.

Pathological Anatomy. In severe or fatal cases of influenza the blood exhibits a deep color, and its coagulation is imperfect. The other pathological appearances are those that are characteristic of mucous inflammations and of the complications that have produced a fatal termination.

Diagnosis. During an epidemic of influenza there is a popular inclination to invest every catarrhal disorder with the name of the current epidemic. In this way it may be frequently confounded with *acute catarrhal gastro-enteritis*, with *typhoid fever*, or with *tuberculosis*. From all these diseases it may, however, be soon distinguished by its course; by the generalization of its symptoms throughout the mucous membranes of the entire body; and by the intensity of the nervous prostration that accompanies its evolution.

Prognosis. Uncomplicated influenza seldom proves fatal; but when it attacks patients who are already suffering from previous disorders of the thoracic or abdominal organs, or from any cause of general debility its risks are greatly increased. Among young children and old people

mplicating pneumonia is the cause of great fatality. During certain idemics, especially those that occur in cold and damp weather, and nder unfavorable social and hygienic conditions, the mortality has been ery considerable. Of the three principal varieties of the disease, the oryzal or *cephalic form*, though the most painful, is the least fatal. The *abdominal form* ranks next in the order of danger, while the *horacic form* is the most dangerous of all.

ETIOLOGY. Influenza is a disease that prevails endemically in the astern portions of Russia and in Central Asia. From these regions, nder favoring influences of cold damp weather, it extends epidemically, nd enters Europe, traversing the civilized world from east to west, preading like the cholera in every direction, yet with greater rapidity, n account of the volatile character of its contagion. The active agent s of bacterial origin, and has been demonstrated as a specific bacillus. The various forms of streptococcus, staphylococcus, pneumococcus, and ther bacteria, have been also found in the mucous discharges from the ir-passages; and by their invasion of the organism, secondary phe-nomena and complicating diseases are produced.

It is in large cities, where the population is densely crowded, that nfluenza prevails with the greatest virulence. During its prevalence, he epidemic tendency induces a predominant occurrence of diseases of he respiratory organs, together with neuralgic, rheumatic, and nervous ffections. There is also a marked tendency to debility and to retarded onvalescence from the majority of other acute diseases, although their ourse may not be appreciably influenced by the prevalence of influenza. Occasionally longer or shorter, the duration of local epidemics varies rom one to two months.

TREATMENT. During the period of invasion, in mild forms of the isease, active medication is unnecessary. The patient should remain n-doors and in bed; a hot foot-bath, Dover's powder at night, herb eas, lemonade, or whatever drinks may be most agreeable, may be llowed in abundance. If the bowels are constipated, a Seidlitz powder r a dose of citrate of magnesia will suffice for their evacuation. ronchial catarrh and cough may be relieved by the ordinary mixtures at are useful in such cases. Nausea and gastric distress, accompanied severe headache, may often be relieved by an emetic. For this pur-se a hypodermic injection of apomorphia is to be preferred. Minute es of the same drug, in combination with liquor ammoniæ acetatis the compound tincture of opium, will be useful. Headache may relieved by antipyrine, phenacetine, and similar preparations; but must not be continuously administered, because of the nervous ustion and retarded convalescence which their long-continued use sions. The various preparations of opium, and anodyne combina-s like chlorodyne, are to be preferred in the majority of cases for relief of pain. During convalescence, iron, quinine, strychnine, r of calisaya-bark, compound tincture of cinchona, and other table bitters are needed for a considerable period of time. Good and, if possible, a change of air, are needful. The patient must rd against exposure to cold and damp, and must avoid fatigue until health is restored. Complications and intercurrent diseases require ir own specific treatment.

CHAPTER IX.

DIPHTHERIA.

DIPHTHERIA is an acute, infective disease, caused by local contagi producing upon the mucous or cutaneous surfaces of the body an e dation of false membrane, in which are developed the specific mi organisms of the disease. From these local points of contagion, tissues of the entire body become infected with the products of terial life.

SYMPTOMS OF THE DISEASE. *Diphtheria* manifests itself with v ing degrees of severity. In certain cases the local lesion is the pr nent feature, while the symptoms of constitutional infection are slightly manifested. In other cases, there is, in addition to active extensive local disease, a development of the symptoms of severe stitutional infection. In a third class of cases the local symptoms insignificant in their character, while the evidences of universal i tion are rapidly developed, and are followed by the most serious fatal consequences. These three forms of the disease require sepa consideration.

1. *The benign form.* The local lesions in this variety of diphth are usually manifested in the throat. It commences with the ordi symptoms of a simple sore-throat, characterized by a chill, consider fever, a feeling of prostration, increase of temperature, and elevatio the pulse. These febrile symptoms are sometimes almost, if not wh absent. Inspection of the throat reveals a reddened condition of soft palate, fauces, and pharynx. In the course of a few hours a pellicle appears upon some portion of the tonsils or faucio-pharyn walls. It is the false membrane. At first very thin, white, restricted, it extends and becomes thickened and surrounded by a of mucous inflammation. It does not extend into the nasal pass but it occasionally descends into the larynx, where, in this mild of the disease, it only occasions difficulty through the partial obs tion of respiration. The glands behind the angle of the jaw are s what enlarged, but the evidences of constitutional infection are ab and at the expiration of a week the patient recovers.

2. *The infective form.* In this variety of diphtheria the false brane may appear in the throat, as in the previous variety, or it be first developed in the nasal passages, or even upon the cutan surfaces of the body. The false membranes are not limited, as i benign form of the disease, but extend widely, covering the tonsil walls of the pharynx, the soft palate, invading the nasal passage larynx, the trachea, and the bronchi. It may also appear upon a the other mucous surfaces, or upon any previous wound or ulcer of the skin. The lymphatic glands in the neighborhood of the dation become inflamed and enlarged, sometimes even to sup

tion. The surrounding areolar tissue also shares in the inflammatory process.

The general symptoms at the commencement of the attack correspond with those of the benign form, but as general infection progresses, the evidences of universal prostration appear. There is no relation between the degree of general infection and the amount of febrile disturbance. Frequently the most dangerous cases run their course without any considerable elevation of temperature or disturbance of the pulse. Sometimes the pulse-rate is reduced to fifty or sixty beats in a minute, and the action of the heart is correspondingly enfeebled. If the pulse be rapid it is weak and thready. The countenance of the patient assumes a mournfully apathetic expression, the eyes become surrounded with dark circles, the skin assumes a leaden pallor, and the brilliant color of the mucous membranes gives place to a cyanotic hue. There is complete loss of appetite, the bowels are usually constipated, but there is seldom any other gastro-intestinal disturbance. Albuminuria is not uncommon. Hemorrhages from the mucous surfaces frequently occur, and there is extravasation of blood at various points beneath the surface of the skin and into the tissues of the body. The mind remains clear, convulsions sometimes occur, either at the commencement or at the close of the disease, in children. Death is the usual termination of this form of the disease, though recovery may take place in certain cases in which the phenomena of general infection have been comparatively limited. Death usually occurs as the consequence of general blood poisoning and exhaustion, or as a consequence of the extension of the false membranes into the respiratory passages. Diphtheritic paralysis usually follows these severe forms of the disease.

The duration of this form of diphtheria usually exceeds a week. Death frequently occurs about the tenth day, though life may sometimes be prolonged for a month before death or recovery. In certain rare cases recovery is effected, though the diphtheritic process may persist in the nasal passages for many months, constituting what has been described as *chronic diphtheria*.

3. *Malignant diphtheria.* In this form the symptoms of constitutional infection constitute the prominent features of the disease. In certain cases the attack advances with great rapidity, and death may remove the patient in less than twenty-four hours, or within three or four days at the latest. In these cases the false membranes have not time for their complete development, and the patient dies in a state of collapse, following a sore-throat that was characterized by very moderate local changes. In other cases the local phenomena develop with great intensity, and tend to generalize themselves most extensively. The exudations are of a dirty, pultaceous character, and exhale a gangrenous odor; hemorrhages appear everywhere, the cervical glands become greatly enlarged, albuminuria frequently exists, and death inevitably follows after the expiration of three or four days.

In other cases the disease develops insidiously within the nasal passages, or in some other concealed locality, so that the initial changes may almost escape observation. Fever is usually absent, and there is intense prostration with diminution of all the vital functions; the

patient is inclined to sleep, though perfectly intelligent when awa
The countenance becomes pale, the features wear a mournful expressi
the glands in the neck become greatly enlarged, out of all proporti
with the limited character of the exudations in the throat or nose.
the expiration of about a week, the false membranes disappear, and
hope of recovery arises in the minds of the attendants. This, howev
is doomed to disappointment, for the prostration of the patient increas
the pulse grows weaker, a fatal restlessness appears, but is often s
ceeded by an apathetic calm which terminates gradually, or sometim
abruptly, in death. In other cases the patient seems unmindful of
situation, and notwithstanding the evidences of general exhaust
is disposed to sit up in bed, to move about, or, if a child, perhaps
manifest a languid interest in his playthings until life is suddenly t
minated during some form of muscular effort.

These insidious forms of the disease are almost invariably termina
by death after the duration of a week or ten days.

Special Symptoms. *Fever.* There is no conformity between
lesions of diphtheria and the *febrile movement* that may exist. It
sometimes wholly absent. It may be very severe at the commen
ment of benign cases of the disease, and it usually subsides as malign
symptoms become developed. In like manner the *temperature* does
rise in correspondence with the intensity of the disease. The *p*
may be very rapid and feeble, or it may remain at the normal fig
or it may even be depressed below the usual rate. During the
hours of the malignant forms of the disease it may fluctuate widel
it diminishes in force. The movements of *respiration* increase t
rate during the febrile stages of the disease and during the approac
death in fatal cases. In other stages of the disease they may res
their normal course.

It occasionally happens that during the course of diphtheria cer
cutaneous eruptions make their appearance; they may be observe
all forms of the disease, though they exercise no influence upon
course; they often resemble the eruption of scarlatina, measles,
thema, or urticaria. Occasionally a vesicular form of eruption ma
presented. These exanthems occur during the first week, and sel
persist longer than one or two days. In rare instances gangre
the skin has been known to follow a vesicular or pustular eruption

Albuminuria occurs not unfrequently during the course of d
theria, as in other infective diseases. It may be discovered in
than one-half of the cases. It is of brief duration, and is only occa
ally accompanied by uræmic symptoms. *Œdema* and *dropsy* are
of very rare occurrence.

In certain very rare cases sudden death occurs during the cour
diphtheria, or even during the period of convalescence, as a c
quence of *thrombosis*, involving the cavities of the heart, or its nut
vessels.

Diphtheritic paralysis. During the period of convalescence
severe forms of diphtheria, and occasionally after the milder inci
of the disease, the phenomena of paralysis are sometimes develo
they usually commence from ten to fifteen days after the conclusi

the original malady, though their commencement sometimes occurs earlier, or even much later.

The symptoms of paralysis are generally manifested by the muscles of the palate and fauces; speech becomes nasal and retarded; there is snoring during sleep; deglutition is difficult, and liquids are returned through the nose. In severe cases it becomes difficult to swallow solid food; alimentary particles may find their way into the larynx, where they excite cough, and sometimes produce suffocation; the palate remains immovable and insensible, reflex and voluntary movements of its muscles have ceased; the tongue, the lips, and the cheeks may become invaded by the progressive paralysis; it may extend to other parts of the body and extremities, and may also invade the sensory apparatus, though usually limited to the mouth and throat. Commencing in the lower limbs, *paraplegia* is the most common form of diphtheritic paralysis when it exceeds its usual limits. The upper extremities may also be invaded, and in like manner the neck, the face, the intercostal muscles, and even the diaphragm may become paralyzed. Simultaneous affection of these muscles is necessarily fatal, but their separate or successive invasion is usually followed by recovery. The muscular fibres of the bronchi are occasionally involved, with consequent difficulty of respiration and passive congestion of the lungs. The heart does not always escape; its fibres may be invaded to a degree that causes præcordial distress, cardiac palpitation and intermittence, dyspnœa, tendency to syncope, irregularity and weakness of the pulse. These cases are frequently fatal. The muscular coats of the intestines and bladder are sometimes paralyzed, producing a corresponding disturbance of the function of those organs.

Diphtheritic paralysis usually manifests itself symmetrically upon both sides of the body, but sometimes it presents a hemiplegic aspect.

The various forms of *sensibility* are liable to share in the paralytic tendency; it may be completely abolished in certain localities, but usually it is only slightly diminished. The opposite condition of hyperæsthesia has been discovered in certain very rare instances.

The *organs of special sense* are also sometimes affected by the general reduction of power. The visual capacity may be diminished all the way to a complete, though usually temporary, loss of sight. The pupils are dilated and motionless when both eyes are affected, but they are unequal in diameter if one eye only is involved. There may be strabismus, consequent upon inequality among the muscles of the eyeball, and the power of accommodation is also lost. These different varieties of ophthalmoplegia are transient, and terminate in recovery after several days, weeks, or months.

The other special senses are less frequently affected, but the power of *speech* is sometimes seriously compromised. In certain cases the power of articulation is entirely deficient; in others, it is impossible to articulate labial and lingual sounds; in others, there is a stuttering or stammering utterance. When with these difficulties of pronunciation are present the phenomena of facial and palatal paralysis, the condition of the patient closely resembles that which is produced by labio-glosso-laryngeal paralysis.

In certain instances the *tendon reflexes* are temporarily abolished.

The *intellectual faculties* remain without serious disturbance, though the patient may seem to be enfeebled, and his countenance may lack intelligence through the more or less extensive paralysis of the muscles of expression.

When the phenomena of paralysis are extensively developed, there may be great prostration, marked by constant restlessness, sometimes accompanied by convulsions and coma. Difficulty of deglutition may produce such a disgust for food that the patient may fall into a state of marasmus and inanition marked by vomiting, diarrhœa, and profound cachexia. Fortunately, however, the majority of paralytic cases result in recovery; the degree of mortality is only about twelve per cent. The lower limbs are the first to resume their function; recovery usually progresses in the order of the attack, so that the muscles which were first disabled are the first to recover their function.

The duration of diphtheritic paralysis is exceedingly variable; when confined to the muscles of the throat it may not continue longer than a week, though its duration is usually much more considerable. When the paralysis becomes general, it frequently persists for a number of months; it rarely continues longer than six or eight months, though cases of permanent weakness, involving a limited group of muscles, have been occasionally observed.

Diphtheritic paralysis may follow any of the forms of diphtheria. The frequency of this sequence is exceedingly variable in the experience of different observers. According to Sanné, it was eleven per cent. in a total of thirteen hundred and eighty-two cases that passed under his observation.

Pathological Anatomy. The false membranes of diphtheria consist of an exudation that is formed upon a highly inflamed mucous surface, or upon cutaneous surfaces that have been subjected to previous injury. The exudation appears at first in the form of minute, thin, opalescent or white patches that increase in thickness and become of a dirty or yellowish color, presenting the appearance of a necrotic spot in the mucous membrane. As a consequence of local infection the epithelium of the invaded portion is compressed and degenerated by the infiltrating exudation, which consists of coagulable lymph that forms a delicate network of fibrinous filaments among the epithelial structures and connective tissue of the mucous membrane. Involved in this network, appear numerous leucocytes, blood corpuscles, and parasitic bacteria. Among these may be discovered, about the second or third day, the pathogenic bacilli which are the cause of the disease. The tissues beneath the false membrane contain round cells, fibrinous filaments, and other products of inflammation. The blood and lymph vessels are dilated and distended. The mucous glands are in a similar state of distention. The glands of the tonsils exhibit great congestion, with an exudation into their ducts which is continuous with the external false membrane. In mild forms of the disease, the mucous membrane is but slightly altered beneath the false membrane; but in severer forms of the disease the exudation penetrates beneath the mucous surface. Within the *air-passages*, which are lined with cylindrical epithelium

the products of exudation are less adherent and may be easily detached. The *lymphatic glands* in the neighborhood of the seat of exudation are infiltrated by a serous liquid containing bacteria. The elements of the glands are increased by cellular proliferation and infiltration. Many of the cells have undergone degeneration or even destruction through the compression to which they have been subjected. As a consequence, small abscesses are frequently found in the lymphatic glands.

The *kidneys* are almost invariably affected, and an acute, diffuse nephritis is universal. This, however, does not invade the organs symmetrically or totally, hence the rarity of uræmia and dropsy in connection with diphtheria.

The *blood* exhibits the characteristic appearance caused by the dissolution of its elements. It is a dark fluid, with absence of fibrin, or it may present the appearance and consistency of gooseberry-jelly, producing loose and soluble clots in the heart and large vessels. The red blood-corpuscles are largely reduced in number, and their hæmoglobin is diminished in quantity.

The *organs of respiration* may present any of the different acute diseases to which they are liable. The *heart* and the pericardium are sometimes affected, as in other infective diseases, by the inflammatory and degenerative alterations. To the same class of changes must be referred the atrophy and fatty degeneration of the muscles, which especially occur in those muscles that lie nearest to the diphtheritic exudations.

In the *spinal cord*, the gray matter and its neuroglia exhibit evidences of a slight inflammation, which also involves the anterior roots of the spinal nerves. This inflammatory affection reaches the motor fibres of the peripheral nerves, and may be traced as far as their intramuscular terminations, thus explaining the paralytic condition of the muscles with which they are connected.

Etiology. Diphtheria is a disease that prevails *epidemically* in newly settled countries where it has not previously been known, but in old and densely populated communities it tends to become *endemic*. It is now persistent in all the large cities of the northern hemisphere that lie within the temperate zone. Its prevalence and its virulence are aggravated in proportion to the severity of the climate and its nearness to the northern limits of population. Cold, damp weather, such as prevails during the spring and autumn of the year, favors the spread of the disease. Warm weather, that helps free ventilation of habitations, causes its decline and disappearance.

Diphtheria is an emphatically *contagious* disease. It may be transferred directly from person to person by particles of matter derived from the focus of inflammation. In this way, physicians, nurses, and companions of the sick are continually infected. In the act of coughing contagious particles are driven into the face of the attendant, and finding lodgment upon the respiratory mucous membranes, become centres of infection. Physicians have lost their lives through an incautious zeal that has impelled them to attempt the dislodgment, by suction, of mucus from a tube that had become clogged after the operation

of tracheotomy. Children have been infected by nursing the breast a mother who had just previously given suck to a diphtheritic infant.

That diphtheria may be transmitted by *inoculation* is a fact of da demonstration in the laboratories of pathology, where the transmissi of the disease to animals, for purposes of experimentation, is a mat of frequent occurrence. In like manner, human subjects have be accidentally inoculated in the course of operations for the relief of dip theritic patients. In the majority of cases such inoculations ha proved harmless, but in certain instances they have resulted in t development of the disease. The probability of such inoculation greatly increased if it be effected by contact with fragments of the fa membranes of diphtheria or with the liquids which they contain, the reason that it is in these that the contagious virus exists.

The contagion of diphtheria may be transmitted through the *medi* of the *atmosphere* that surrounds the patient. Minute particles false membrane find their way into the air during the act of coughi or expiration. Dry fragments of false membrane become pulveri and rise in the form of dust in the air of an ill-ventilated apartme In this way a susceptible person may become infected by simple entra into the house where diphtheria is prevailing. Particles of false me brane that have become temporarily attached to clothing and fur, t hair of animals, or other movable articles, may contaminate the atm phere at a distance from their original source. Falling upon t mucous membranes of the respiratory passages, or upon denuded su faces of the skin, they become centres of contagion.

It thus appears that the propagation of diphtheria depends in eve instance upon the transmission of a contagion that is derived from t false membranes that are produced in the course of the disease. T active agent of this contagion is a minute bacillus, discovered by Löffl Numerous observers had demonstrated the existence of bacteria whi swarm in great variety in the substance of the false membrane, but first demonstrated the fact that the active and specific agent is a bacill of which the length is about the same as that of the tubercle bacill but its diameter is somewhat greater. It is either rectilinear, or sligh curved at one of its extremities. The larger specimens appear to composed of several segments, and they are slightly thickened at th extremities. Besides these pathogenic bacilli, the pyogenic bacter staphylococcus and streptococcus, are also present, but they have nothi to do with the direct causation of the disease.

The diphtheritic bacillus proliferates extensively in the substance the false membranes, but *does not penetrate into the blood* or into t organs of the body. It is confined to the primitive focus of the d ease, where it secretes a *chemical poison* that enters the circulation a is transmitted to every part of the body. This poison has been isolat and may be preserved, either in the liquid state or as a desiccated m that retains its active properties for a long period of time. Injec into the bodies of animals, it produces virulent effects identical w those that are produced by inoculation with the false membranes diphtheria.

From these considerations it follows: 1. That diphtheria is a lo

disease produced by contact with matter that is charged with a specific bacillus. 2. That the growth and multiplication of this agent results in the development of a specific inflammation at the point of contact, with production of a false membrane that is infested with pathogenic microörganisms. These do not spread beyond the seat of inflammation, but they generate a diffusible poison that is conveyed to every part of the body, and produces the successive phenomena that characterize the general course of the disease.

The relation between climate and weather and the propagation of diphtheria has already been mentioned. It is probable that the existence of catarrhal inflammations of the throat operates powerfully as a predisposing condition for the reception of diphtheritic contagion. For this reason the disease prevails more frequently and with greater virulence among children, who are particularly liable to inflammatory conditions of the respiratory passages. Social misery, with all its accompanying defects of hygiene, by effecting a reduction of physical vigor, may also predispose to the occurrence of diphtheria; but only in this indirect manner can such conditions operate. Adult life, good hygiene, dry climate, wholesome habitation, and the absence of predisposition to disease, constitute the conditions most favorable to avoidance of the invasion of diphtheria.

Previous experience of the disease affords no protection against its recurrence, though it is believed that the first attack is more dangerous than subsequent invasions.

Secondary Diphtheria. Diphtheria may occur as a complication of other infective diseases, either in their course, or as their sequel. It is most frequently observed in connection with measles, scarlet fever, tuberculosis, and whooping-cough. After these, though at a considerable distance, may be numbered typhoid fever, bronchitis, pneumonia, pleurisy, and smallpox. Scarlet fever is more frequently than measles associated with diphtheria. The apparent preponderance of measles is owing to the greater prevalence of that disease, affecting the entire population, while scarlet fever attacks only a moderate number. It is through the inflammatory condition of the respiratory passages by which these diseases are characterized that predisposition to diphtheria is produced. Previous inflammation prepares the way for the reception of diphtheritic contagion.

Diagnosis. The occurrence of sore-throat, with an abundant exudation of false membranes upon the tonsils, fauces, or pharyngeal mucous membrane, accompanied by swelling of the glands behind the angles of the jaw, cannot be mistaken for any other disease than diphtheria; but there are cases in which the absence of local symptoms in the throat, and the lack of definition in the general symptoms render diagnosis difficult. It is well to remember the advice of Trousseau, who recommended a careful examination and search for the manifestations of diphtheria in every case where an infant exhibits ill-defined symptoms of disease that cannot be readily referred to a specific cause. In such cases inspection of the fauces will frequently throw unexpected light upon the nature of a malady about which a nursling is unable to utter any complaint. Mild forms of the disease can be scarcely distinguished

from simple cases of catarrhal tonsillitis. Malignant cases that termi
nate fatally in the course of a few hours may sometimes occasion doub
as to the diagnosis; but their occurrence in the course of an epidemic,
and the existence of catarrhal symptoms involving the respiratory
passages, should render the diagnosis quite certain. In local house
epidemics it is not uncommon to observe varying grades of intensity
in the symptoms that are manifested by the different members of an
infected family. All such cases are, however, infective, even in the
mildest form.

It is in the insidious forms of the disease that the greatest difficulty
attends the diagnosis at the commencement of their course. The local
manifestations of the disease may be concealed in the posterior nasal
passages, and only the general symptoms of constitutional infection
attract attention. In such cases the course of the disease will suffice t
clear up the diagnosis. Initial somnolence, slight fever, general pros
tration, utter loss of appetite, enlargement of the cervical glands,
slight discharge from the nostrils, a leaden pallor of the countenance
an expression of listless sadness, hemorrhagic discharges from th
mucous surfaces of the body, with or without petechial eruptions, hea
failure, collapse, and death, form an assemblage of symptoms that ca
scarcely be ascribed to any other known disease. Even though n
visible false membrane may appear before death, a carefully conducte
autopsy will, however, invariably reveal a local origin for the disease.

PROGNOSIS. From the preceding considerations it follows that th
prognosis of diphtheria is exceedingly uncertain. The malignant form
are always dangerous. The greater the rapidity with which the dis
ease develops, and the greater the extent of the false membranes, th
greater the dangers that accompany the course of the disease; but man
a mild form of the malady becomes insidiously transformed into a mo
malignant case before its fatal termination. The occurrence of fals
membranes in the nose, or upon the conjunctiva, in the Eustachia
tube, or about the organs of generation, is a most portentous circum
stance. Invasion of the larynx and bronchi is attended with a hig
rate of mortality; though dyspnœa may be relieved by the operation
tracheotomy, the patient still remains liable to death from constitutiona
infection.

Secondary diphtheria is always attended with extreme danger
Relapsing diphtheria is far less dangerous.

The age of the patient exerts a great influence upon the rate
mortality. The greatest fatality is experienced during the first thre
years of life. Old people and those who have been exhausted by pre
vious disease, or unfavorable conditions of existence, also exhibit
high rate of mortality. Sex appears to exert no particular influenc
upon the course and termination of the disease. Congenital tendencie
to tuberculosis, such as are indicated by the so-called lymphatic
scrofulous diathesis, add considerably to the dangers of diphtheria
such patients lack the degree of stability that is necessary for successfu
resistence to the disease.

TREATMENT. Mild and uncomplicated forms of diphtheria recov
spontaneously without treatment, though they may be occasionally f

lowed by the symptoms of paralysis. Severe forms of diphtheria demand the most energetic treatment that can be furnished from the resources of medicine and surgery.

The management of diphtheria demands, in the first place, attention to the restriction of the disease, so that it shall not spread to others from the original patient. For this purpose all persons, excepting those who must care for the sick, should be excluded from the house. Physicians and attendants must observe every precaution against contagion. The utmost cleanliness must be secured by frequent washing of the hands with antiseptic lotions, and by gargling of the mouth and throat with solutions of boracic acid, salicylic acid, or permanganate of potassium. All articles of clothing that have been used about the patient should be placed for twelve hours in a five per cent. solution of carbolic acid before they are boiled and washed.

The treatment of diphtheria consists in the employment of remedies that are directed, in the first place, against the local disease, and against general intoxication of the system, in the second place. The local applications in the throat should have for their object the disinfection and destruction of the false membranes. For this purpose the fauces and pharynx may be swabbed with a solution containing one part of the corrosive chloride of mercury, and five parts of tartaric acid in 1000 parts of distilled water. With this solution the membranes may be wiped off from the mucous surface; at the expiration of an hour the operation may be repeated. It is seldom necessary after such thorough application of the remedy to reapply it more than twice a day. Forcible removal of the false membranes, and cauterization of the throat should be avoided, because all such local injuries favor the absorption of the diphtheritic virus. Additional disinfection of the mouth and throat may be secured by frequent irrigation with solutions containing either 2 per cent. of carbolic acid, 4 per cent. of boracic acid, 2 per cent. of salicylic acid, or 1 per cent. of thymol. Adults and children of considerable age can easily be treated by this method, but young children who cannot understand the object of such disagreeable operations must be dealt with in a very summary way. The little patient should be wrapped in a sheet so that he cannot use his hands or his feet, and should then be placed upon the lap of his nurse, by whom he is firmly held. A second person standing behind the nurse should place a hand upon either temple of the child, and at the same time press upon the cheeks or compress the nostrils in such a way that the patient must open his mouth. A suitable gag must then be placed between the teeth, and in this immovable position the mouth and throat may be easily and thoroughly irrigated by means of an ordinary irrigation-tube. Nasal diphtheria may be reached in the same way by introduction of the tube into the nostrils.

For the purpose of facilitating the solution of the false membranes, they may be swabbed every four hours with lactic acid; or with chinoline five parts, alcohol and distilled water each fifty parts; or every four hours with a solution containing one part of papayotine in twenty parts of distilled water, with hydrochloric acid sufficient to give an acid reaction.

Various powders have been recommended for application by insuff
tion into the throat, *e. g.*, quinine, sulphur, borax, benzoate of sodiu
iodoform, salicylic acid, chloride of sodium, and finally pulveriz
sugar. Patients of age and intelligence sufficient to enable them
employ gargles, may be instructed to use for this purpose lime-wate
or a two per cent. solution of chlorate of potassium, or alcohol an
water of a strength that can be tolerated, permanganate of potassiu
in solution, etc. An excellent gargle may be prepared with chinolin
one part, alcohol fifty parts, and distilled water five hundred parts.

If it be thought desirable to make use of medicated inhalations, the
may be administered with an ordinary spray-producing apparatu
Chlorate of potassium in two per cent. solution; carbolic acid of th
same strength; corrosive chloride of mercury in a very dilute aqueo
solution; peroxide of hydrogen; lactic acid; oil of eucalyptus; oil
turpentine; benzoate of sodium, etc., have all been employed in th
manner.

As a part of the local treatment may be considered the admin
tration of ice, and the use of chlorate of potassium with tincture
sesquichloride of iron, which has been so extensively employed.

The general treatment of diphtheria demands attention to the no
ishment of the patient. A diet of milk, raw eggs, rich broth, pep
noids, and minced meat, should be given in sufficient quantity. If
patient will not, or cannot, take food by the mouth, it should be adm
istered by injection into the rectum. Among the most import
therapeutic agents in the treatment of diphtheria, is alcohol, wh
antagonizes the poisonous excretions of the diphtheritic bacillus v
much as it operates to prevent the influence of snake poisons and ot
virulent substances. It may be administered in any form that is ag
able to the patient, and to any extent short of actual intoxication.

Febrile symptoms, if present, may be antagonized by the adminis
tion of antipyrine in doses proportioned to the age of the patient.
cases marked by a high temperature, the employment of baths
hydropathic measures has been found highly beneficial.

Oil of turpentine in an emulsion, of which a teaspoonful contai
five drops may be given every three hours, has been considered a rem
of great value. It may be given also in a mixture containing four p
of the oil with one part of the spirits of ether. To children under
years of age, a teaspoonful of this mixture may be given every
to older children a double dose, and to adults a tablespoonful.

In cases marked by great prostration, powerful heart stimulants,
as camphor, ether, and musk, must be employed.

Invasion of the larynx and trachea by the diphtheritic membr
requires a renewal of vigor in the employment of medicated inh
tions. For this purpose are recommended lime-water and disti
water in equal parts; or one part of the corrosive chloride of mer
in 4000 parts of distilled water; or five to ten parts of the oi
eucalyptus with twenty-five parts of alcohol in 180 parts of disti
water; or a two per cent. solution of carbolic acid. With the deve
ment of the symptoms of laryngeal obstruction it is advisable to
recourse to the use of emetics. Syrups of ipecac and squills ma

given every ten minutes until vomiting is produced. If this fails to give relief, intubation of the larynx may be performed; but if this measure prove insufficient, the operation of tracheotomy must be performed without delay. The period of convalescence requires a free use of iron, quinine, and alcoholic stimulants. Paralysis and other complications must be treated in accordance with the general principles that control their medication.

CHAPTER X.

TETANUS.

Etiology. Tetanus is frequently excited by the infection of a wound with impurities containing a specific bacillus, the *tetanus bacillus*. Sometimes the disease occurs though it be impossible to detect any wound or external injury through which an infective process could be excited. The virulent microphytes exist in the soil, especially in certain localities where the disease frequently occurs among animals and men whose feet have been wounded and impregnated with infected mire from the roads or fields. The bacilli proliferate in the wound to which they have obtained access, but do not pass thence into the tissues throughout the body. They secrete upon the spot a poison which is slowly absorbed and infects the body at large, producing the symptoms of the disease principally through its action upon the nervous centres. The infective substance belongs to the class of tox-albumins; it is a soluble, diffusible, chemical compound which acts by virtue of its chemical properties upon the tissues of the body.

Tetanus occurs more frequently in certain localities than in others. It is especially common in warm climates during the hot season of the year. Considerable variations of temperature favor the occurrence of the disease, as when cold nights succeed hot days. A neglect of hygienic precautions, with residence in close, unventilated, and filthy houses are also favorable to its manifestation. Under such circumstances newborn children frequently fall victims to tetanus (tetanus neonatorum), the infective process being usually accomplished through lack of cleanliness in the care of the umbilical cord. The disease is often encountered as a consequence of bullet wounds and other injuries received in battle. It is especially frequent among the wounded soldiers of the defeated army who are compelled to march or are transported under depressing circumstances during bad weather, and are exposed to privation and misery beyond description.

The attempt to show that certain races are more susceptible than others to tetanus has failed to indicate anything more than the fact that habits of cleanliness and wholesome living are more carefully practised in certain regions of the world than in others. The more frequent incidence of the disease among males in middle life is due to

the fact that such people are most exposed to injuries and to the causes of infection.

The nature of the injury exerts considerable influence upon the occurrence of the disease. It is more often observed after contused and ragged wounds into which foreign bodies have been forced in the act of traumatism. Wounds of the extremities are more liable to infection than those of the trunk, probably on account of their greater exposure to uncleanliness. Minute punctured wounds also seem to be more dangerous than those which are wide and gaping. Sometimes tetanus is developed after simple concussions of the brain and of the spinal column.

Tetanus sometimes occurs as a consequence of infection through the uterine passages after childbirth or abortion. Infection may also occur through ulcers in the rectum, to which the infective agent has found access through the medium of a clyster.

It was formerly supposed that rheumatism might act as an exciting cause of tetanus, but it is now believed that rheumatism and exposure to cold and wet merely act as predisposing causes which facilitate the action of the specific contagion. It seems to be, however, admitted that sometimes it is impossible to discover the mode of infection; to designate such cases, the term *idiopathic tetanus* is employed.

SYMPTOMS. The period of *incubation* is of uncertain duration. It occasionally occupies only a few hours, but it is frequently prolonged through an entire week.

The *invasion* of the disease is usually gradual. Sometimes the infected wound changes color and becomes painful. The nerves that extend from the wound toward the central nervous organs become the seat of pain. The patient is restless and irritable. Pain and stiffness are presently experienced in the neck, fauces, and jaws, and finally the muscles are invaded by the characteristic tetanic spasm.

It is in the muscles of mastication and deglutition that the first symptoms of spasm are manifested. The muscles of the neck are then invaded, and finally the muscles of the back, body, and extremities participate in the disease. The occurrence of spasm in the muscles of mastication is designated by the term *trismus*. In adult cases the muscles of the extremities sometimes escape, but in children all the muscles of the body and extremities participate in the convulsive paroxysm. When the disease is fully developed, the eyebrows are elevated; the forehead is wrinkled; the nostrils dilate; the corners of the mouth are drawn upward and outward, revealing the teeth, which, however, cannot be separated by reason of tonic spasm of the masseter muscles; the head is drawn backward; the spinal column is stiffened and arched; during the paroxysms of tonic convulsion the weight of the body is frequently supported upon the back of the head and sacrum, constituting the condition that is known as *opisthotonus*. The muscles of respiration share in the spasm, so that breathing becomes difficult, and the blood is very imperfectly aërated. Death not unfrequently results from spasm of the glottis and suffocation. The abdominal muscles are contracted and hard; partial priapism often exists, and all the muscles of the extremities are thrown into a state of rigid contraction.

ome cases a condition of tonic spasm continues with scarcely mission, only varied by recurrent exacerbations of convulsion, ther patients experience intermissions of considerable duration n the tetanic paroxysms. In such cases clonic convulsions are nes witnessed, and it is evident that there is great *increase of excitability;* the slightest touch, breath of air, sudden increase nt, or an audible sound may suffice to excite a convulsive sm.

sciousness is usually retained during the greater part of the , but sometimes the mind wanders toward the close of life. The t is alive to his danger, complains of soreness and pain in his s, and experiences the most doleful forebodings of evil.

many cases the *temperature* remains without change. It is nes subnormal, but occasionally it is greatly elevated shortly death, a fact that indicates the extension of the disease to the tive centres of the brain.

pulse is usually accelerated and is sometimes quite irregular. *kin* is generally covered with perspiration as a consequence of sis of the regulative centres in the cord and brain. *Cutaneous ility* remains without notable change. The *reflexes* are usually sed, but are sometimes diminished.

bowels are constipated, and *urine* is evacuated with difficulty. canty, high colored, and often contains urates. Sometimes also in and sugar are present.

duration of the disease is exceedingly variable. It is customary connection to cite the case of a negro who died within fifteen s after infection. Sometimes the disease is protracted for many and months may elapse before all traces of its existence dis- . Sometimes paralytic conditions are manifested after the nce of the convulsive phenomena.

th usually results either from suffocation, exhaustion, or hyper- a. Bronchitis, pneumonia, and acute nephritis have been d as complications of tetanus.

pecial form of tetanus, designated *cerebral tetanus* or *hydrophobic* , has been observed after injuries of the head, especially in the orhood of the eyebrow. Trismus and facial paralysis occur he side of the injury. Sometimes the paralyzed muscles remain ndition of contracture, resembling spasm rather than paralysis. t of swallowing is difficult. Sometimes general tonic convul- re developed, and the disease frequently terminates in death. ain cases of injury involving the extremities, a *local tetanus* is ed in the neighborhood of the wound, but this localized form of ease may subsequently become merged in the general muscular of universal tetanus.

HOLOGICAL, ANATOMY. The pathological changes that persist eath are largely the result of excessive muscular contraction and y extravasation of blood into the muscular substance. The in the vicinity of an infected wound frequently exhibit a moder- ree of redness with swelling. In newborn children the umbil- tery and vein exhibit evidences of inflammation. Trifling

meningeal hemorrhages are frequently observed. These have noth to do with the causation of the disease, but are the consequences suffocation and of stagnation of the blood.

DIAGNOSIS. Tetanus may be differentiated from *spinal mening* by the absence of trismus in the latter disease. In cases of sim *spasm of the masticatory muscles* the cervical muscles remain affected. Acute *muscular rheumatism* of the back is unaccompai by trismus.

PROGNOSIS. The disease is always attended with great dan Probably more than half the cases prove fatal. The longer the du tion of the disease, the greater the probability of recovery. A l period of incubation is also more favorable than a rapid developm of spasm.

TREATMENT. The greatest care should be taken to insure per cleanliness in all wounds. Exposure to cold and other depress causes should be also avoided. Ragged and punctured wounds sho be converted as far as possible into clean incisions.

After the development of the disease the patient should be nouris with liquid diet, since it is impossible to masticate solid food. bowels should be evacuated with calomel and jalap, and the pati should be kept under the influence of chloral hydrate, which may given to the amount of from half a drachm to a drachm and a half e day. All kinds of narcotic and neurotic remedies have been emplo but with indifferent success, since those which are really powerful influence the nervous system are dangerous when given in suffici doses. Alcohol, chloral hydrate, and the bromides are most us and least attended with danger. Recently the discovery of an a toxine or counter-poison in the blood of tetanized animals, has b followed by its isolation and employment as an antidote to the infec toxalbumin that is secreted by the tetanus bacillus. The injectio this counter-poison into the circulation of a tetanized animal serve neutralize the effects of the contagion, and is followed by recov A similarly successful issue has been obtained in the treatmen tetanus in the human subject, so that there is reason to hope that means of successfully combating the disease may be obtained thro the artificial production of a chemical compound identical with antitoxine that is actually produced during the reaction of the infe tissues.

CHAPTER XI.

TUBERCULOSIS.

TUBERCULOSIS is an infective disease produced by an invasion o organism by the tubercle bacillus, first discovered by Koch in the 1882. The wide diffusion of this bacillus, and the great differe among the local disorders that are produced by its vegetation i

organs and tissues of the body, give to the tubercular process a remarkable degree of variety in the mode and form of its evolution.

The length of the *tubercle bacillus* is usually about one-quarter or one-half the diameter of a red blood-corpuscle, though its dimensions may vary considerably beyond these limits. The little parasite may be easily rendered visible by the method of Ehrlich, which depends upon the fact that when the bacillus has been stained by immersion in an aniline dye, it resists the decolorizing action of nitric acid. (Fig. 77.) The bacilli are either straight or curved. Their substance is homogeneous, or it may be formed of little, rounded masses that are discontinuous. Sometimes little, colorless points are visible within the protoplasm of the bacillus, and these have been supposed to indicate the presence of spores.

FIG. 77.



Bacilli of tubercle from sputum. × 500. (BRISTOWE.)

The microscopical demonstration of tubercle bacilli can be most conveniently performed as follows: A minute portion of the semi-solid or cheesy contents of a tubercular deposit, such as may be found in the sputa, should be placed between two cover-glasses and subjected to pressure by the thumb and finger. In this way the mass is easily spread out between the two glasses, which should then be separated from one another, leaving a thin layer upon each glass. These should be then partially dried by passing them several times through the flame of a spirit lamp, with the sputum side upward. They are then ready for the staining fluid, which consists of a concentrated alcoholic solution of fuchsine. A little aniline oil should be poured into a test-tube, which is then to be filled nearly full of distilled water. The two liquids must be thoroughly shaken together, forming a mixture in which a little of the aniline oil is dissolved in the water. This mixture should be filtered, and a portion of the filtrate be placed in a large watch-crystal. From five to ten drops of the solution of fuchsine should be then added to the contents of the watch-glass, and upon the mixture the cover-glasses are to be floated with the sputal surface downward. The watch-glass should be placed for twenty-four hours under a cover, to protect it from dust; or, if an immediate examination be desirable, the liquid may be heated over a flame until it boils. After lying for ten minutes in this heated fluid, the cover-glasses are ready for bleaching. They should be placed for a short time in a small quantity of absolute alcohol to which a drop of pure nitric acid has been added. As soon as the coloring matter appears to have considerably faded from the sputum-covered surface of the glass, the slip should be removed and washed with distilled water. It may be then mounted with Canada balsam, and placed under the microscope, where it will be perceived that the coloring matter is still retained by the bacilli, while the remaining portions of the sputum are colorless. A very

beautiful effect may be produced by staining the background of the surface with malachite green, which contrasts admirably with the fuchsine tinge of the bacilli.

Another excellent method consists in the substitution of a carbolic solution of fuchsine (one part of concentrated alcoholic solution of fuchsine, nine parts of a five per cent. solution of carbolic acid) for the staining-fluid previously described. By warming this fluid, the preparation can be completed in a few minutes. The background may be stained with an aqueous solution of methylene-blue. The whole process can be greatly abbreviated by simply moistening with the staining-fluid the layer of sputum upon the cover-glass, then warming it quickly over a flame, and washing with distilled water.

Many animals can be *infected by inoculation* with tubercular matter. This is especially true of the graminiverous animals. The carnivora, principally the dog and the cat, are not easily thus infected. If liquids in which the bacilli have been cultivated be subjected to filtration through unglazed porcelain, the microörganisms are retained upon the filter, and the filtrate loses its infective properties, but still contains albuminoid substances that in a concentrated form possess toxic properties. From the filtered liquid may be separated an albuminoid substance that, when injected into the body of an animal, produces an elevation of the temperature that persists for one or two days. Besides this toxalbumin, there is a substance that resembles the ptomaïnes and is poisonous to frogs. From the bacteria themselves may be obtained an alcoholic extract which excites tetaniform convulsions in the guinea-pig, and produces death after a few hours. Another extractive exhibits pyogenic qualities. Other toxic substances have also been isolated from cultures of the tubercle bacillus which produce dangerous and fatal results when injected into the bodies of animals. These experiments of the laboratory serve to explain many of the symptoms that accompany the infective process and the evolution of tuberculosis under ordinary conditions.

The vitality of the tubercle bacillus is very great. Alternate exposure to desiccation and to moisture for many months is without effect upon its organization. It may be immersed for months in water; it may be exposed to putrefaction, or to excessive cold, without destruction. It is, however, destroyed by exposure to the heat of ebullition for four or five minutes, and it perishes rapidly under the influence of sunlight.

The infection of tuberculosis may be transmitted from one human being to another, though this occurs rarely, and only under the most favorable conditions. The parasite is contained only in the sputa and other liquid excreta, so that the danger of infection consists principally in the inhalation of dried particles containing bacilli. The tuberculosis of cattle may be communicated to human beings through the medium of the digestive organs. The flesh of tubercular cattle is infective to certain animals, while others may devour it without harm. It is by many believed that the infective agent is located in the lymph glands rather than in the muscular substance. It may be destroyed by thorough cooking, but the temperature to which roast beef is usually subjected is not always sufficient for this purpose; and the gastric juice

when deficient in hydrochloric acid, does not always destroy the bacilli after they have been liberated in the stomach. If they enter the intestines in a living condition, they may easily penetrate the walls of the viscera and invade the mesenteric glands and other organs of the body. The milk of tubercular cows is more dangerous than the flesh, but if such milk be diluted with from forty to one hundred parts of healthy milk, its virulence is destroyed. It is probable that among human beings, the milk of a tubercular mother can transmit the infection to the infant, but this is not positively demonstrated.

Though it is possible to introduce the infection through the alimentary canal, by far the most common mode of infection is through the respiratory organs. The bacilli are contained principally in the sputa, but they also exist in the saliva of tubercular patients. In this way the contagion can be transmitted. Though it may pass through the mucous membranes of the body, it cannot penetrate the skin unless there be a previous solution of continuity. After the introduction of the contagion, its local manifestation may occur in any part of the body. It frequently becomes thus apparent at the seat of an injury or other accidental lesion.

The tubercular parasite can be transmitted from a tubercular parent to an unborn fœtus. This is not infrequently observed among certain of the lower animals, and it is also possible in the human species. In this way can be explained the numerous deaths from tuberculosis among the newborn children of tubercular parents, though in many instances undoubtedly the disease is acquired by an enfeebled infant after birth. When tuberculosis has been thus derived before birth, the liver is the principal seat of the infective process, since the bacilli have entered that organ through the avenue of the umbilical vein. It is not yet possible, however, to state with any degree of accuracy the frequency of such a mode of infection.

Tubercular lesions present themselves in two principal forms: either as minute *granulations*, which can be most conveniently examined upon the serous surfaces of the body, or in the form of *rounded gray masses*, of the size of a pea or larger, which are infiltrated into the tissues. Besides these ordinary forms are numerous lesions of a different character, which, however, are now recognized as tuberculous, since their existence is dependent upon the presence of the tubercle bacilli. Many scrofulous diseases, chronic abscesses, varieties of lupus, articular and serous inflammations are now classified among the tubercular diseases.

The characteristic histological feature of the tubercular process consists in the development of *elementary tubercles*, which may originate in any tissue of the body. They consist, for the most part, of giant cells, which in their turn are encompassed by a zone of small embryonic cells. These cellular aggregations are non-vascular, since the capillary vessels which have originally permeated the locality become obliterated and disappear.

The *elementary tubercle* may be formed in any part of the body to which tubercle bacilli have found access. These parasites may enter the respiratory passages and fix themselves in the walls of the alveoli, or, having entered the general circulation of the body, they may become

lodged in the spleen, or in the liver, or elsewhere. At the point where they become stationary, under the influence of their poisonous secretions the nuclei of the adjacent cells begin to divide. In consequence of the irritation thus excited, an immigration of leucocytes is set up. The bacilli become surrounded by proliferating cells, of which some become enormously enlarged through the growth of their protoplasm, and by the subdivision and multiplication of their nuclei. These constitute the central giant cells, around which smaller epithelioid cells are grouped, while the outlying periphery of the irritated region is occupied by small, round, embryonic cells. The capillaries disappear by reason of the coagulation of their contents and the pressure that is exercised upon their walls.

The *gray granulations* of tuberculosis (miliary tubercles) are formed by the aggregation of a number of elementary tubercles. The larger tubercular masses are in like manner composed of numerous elementary tubercles, but the central portion of the mass is in a condition of caseous degeneration. The tissue is said to be in a condition of *tubercular infiltration* when it is filled with confluent granulations, constituting gray infiltration, or with caseous tubercles that constitute the yellow or caseous variety of infiltration.

The process of caseation is dependent upon the obliteration of the vascular structure of a tubercular mass. The central portions undergo a vitreous degeneration, which is succeeded by caseous or fatty degeneration of the necrotic cells. These cheesy masses themselves may undergo infection with pyogenic bacteria if they communicate with the external atmosphere. Under the influence of these organisms suppuration occurs, and the cheesy mass becomes softened, dissolved, and evacuated, or removed by absorption. When such infection does not occur it sometimes happens that the tubercle becomes imperfectly organized. It is transformed into a little, hard nodule, composed of a meshwork of fibrous tissue, in which may be discovered the remains of atrophied cells. Capillary vessels make their appearance in the surrounding zone of embryonic cells, among which giant cells that have escaped compression and atrophy may be still discovered. Occasionally the tubercular mass becomes infiltrated with calcareous salts, or with a deposit of pigment.

It has been shown experimentally that irritation of the tissues by the intrusion of various inanimate bodies, like cantharides, lycopodium, Cayenne pepper, etc., produce various lesions that in their general appearance and histological structure closely resemble the lesions of genuine tuberculosis; but this *pseudo-tuberculosis* is non-infective, and does not contain the tubercle bacillus, consequently it cannot be transmitted to other animals, nor does it produce general infection of the organism.

In the lower animals analogous pseudo-tubercular lesions are produced through the invasion of the tissues by certain minute verminous parasites. The eggs, or the little worms themselves, become encysted in a pseudo-tubercular mass composed of giant cells, epithelial cells, and embryonic cells. Sometimes the parasitic ovum or embryo is contained within the protoplasm of a giant cell.

Other microörganisms besides the tubercle bacillus possess the

wer of exciting a process analogous to that of tuberculosis. They y be inoculated into the bodies of certain lower animals, where they liferate and produce pseudo-tubercular granulations, from which the ntagion may be conveyed by inoculation to other animals. It is obable that the progress of investigation will furnish numerous amples of similar infection. In like manner the invasion of animal sues by various mycotic growths may produce lesions and symptoms t unlike those of tuberculosis. Witness the process of actinomycosis. ertain varieties of aspergillus may also act upon the tissues in a similar fective manner.

It is thus rendered apparent that the tubercular lesion possesses othing characteristic but the specific parasite by which it is caused.

The tubercular process occurs most frequently in the lungs; after hose organs follow the larynx, the intestines, and the uro-genital organs. n the following sections the various forms of tuberculosis that fall nder the observation of the physician will be successively considered. Before undertaking this survey a few paragraphs must be devoted to hat predisposition or diathesis by which the invasion of tubercular dis- ase is facilitated.

Scrofula.

Scrofula is a term formerly used to designate a great number of xternal diseases of the cutaneous surface, together with many internal sorders of the lymphatic apparatus and other viscera, which are now ferred either to tubercular infection or to syphilis as their cause. The rd scrofula is now retained only for the purpose of designating that disposition or diathesis which favors the occurrence of tubercular ction. The existence of the *scrofulous diathesis* is most conspicuous arly childhood. It is characterized by a peculiar susceptibility to mmatory processes, and by imperfect resolution of such inflamma- s when once established. Hence the peculiar turgescence of the er lip and nose that is so characteristic a feature in the physiog- y of snuffling, scrofulous persons; a turgescence that is maintained stagnant condition of the lymphatic circulation.

The ultimate cause of the scrofulous diathesis is not yet fully under- d. It is known, however, that various antecedent conditions favor manifestation. Of these, *heredity* is a very potent influence. The dren of scrofulous, tuberculous, and arthritic parents are very liable exhibit the scrofulous diathesis. The children of elderly, feeble, philitic, unequally mated, and cachectic parents are frequently fulous.

The scrofulous diathesis may be acquired through *errors of nutrition*, n young children are brought up by hand, or are nourished with roper food after the period of lactation is past. These unwhole- e conditions may result in the evolution of rickets, or they may duce the scrofulous diathesis; and it is not yet known why these ferent results should follow apparently identical causes.

The development of scrofula is not uncommon during the period of e between the first and second dentitions, when children are confined

in unwholesome, ill-ventilated, damp, and sunless apartments; the diathesis is, therefore, one of the common misfortunes of poverty and neglect.

Scrofula frequently results from the persistent use of a diet in which the proper proportion between nitrogenous food and the ternary compounds is not observed. When the normal proportion of one part of nitrogenous matter to five parts of the carbohydrates is disregarded, the scrofulous diathesis is rapidly created. When this diathesis exists, it is a notable fact that the perspiration and the stools of the patient are excessively acid, and that oxalic acid and the urates frequently appear in the urinary sediment. The contents of the intestinal canal are excessively acid, and the bones are deficient in mineral constituents. These facts indicate a perversion and impediment of the processes of oxidation that should be conducted in the tissues as a necessary condition for healthy nutrition. In this connection it is worthy of note that active exercise in the open air, and everything that favors oxidation and healthy nutrition, are opposed to the manifestation and progress of scrofulous phenomena.

In these errors of nutrition there are many points of resemblance between the scrofulous diathesis and the arthritic predisposition. Both classes of children exhibit the same tendency to obstinate catarrhal inflammations; and scrofulous patients who, under favorable circumstances, have been cured in childhood, not unfrequently manifest arthritic symptoms in later life. The exact nature of the difference between the two diatheses is unknown. The points of resemblance consist in similar errors of assimilation and nutrition.

In the *treatment* of scrofula it is necessary to aid the nutritive processes, and to promote tissue metamorphosis. In scrofulous families the marriage of scrofulous individuals should be discouraged. During the period of pregnancy the health of the mother and her nutritive processes should be carefully supervised, and during the period of lactation every effort should be made to procure for a scrofulous infant the benefit of a healthy wet-nurse. After the period of weaning, the state of the digestive organs should receive constant attention. Excessive acidity should be prevented, and a healthy state of the gastro-intestinal secretions must be maintained. Alcohol, tea, coffee, and tobacco must be rigidly proscribed, since they are not tolerated by scrofulous or arthritic patients. Alkaline salts, rhubarb, and the astringent and bitter tonics are often of great service. The syrup of the iodide of iron and other preparations of iodine, iron, and tannin are among the most useful of internal remedies. A dry, moderately warm, and bracing climate is preferable to a damp and chilly residence in any quarter of the world. The patient should be advised to seek, if possible, a home where active exercise in the open air can be enjoyed during every day of the year. The clothing should be of a character to equalize the temperature of the body at all seasons of the year. The skin should be rendered resistant to cold by daily salt sponge baths, and by liberal friction with the flesh-brush. Cod-liver oil is exceedingly useful as a remedial agent and as an article of nutriment. It should be given in teaspoonful doses shortly after each meal. Its administration should

continued for many months, or even for years. Its taste may be efficiently covered by giving it in the form of an emulsion with maltine, or with pancreatized extract of beef, or, best of all, with fermented milk in the preparation known as matzol.

Pulmonary Consumption—Phthisis Pulmonum.

Etiology. It has been estimated that about one-seventh of the total mortality is due to pulmonary consumption. About two-thirds of the deaths from chronic disease are due to this cause.

Pulmonary tuberculosis is of either primary or secondary origin. In the *primary form* of the disease the contagion enters the lungs from without, and the consequences of infection may be restricted to the respiratory organs, while in the *secondary form* the contagion enters the pulmonary apparatus from some other portion of the body which had been previously infected.

The nature of the contagion, and the manner in which it may be transmitted from one animal or individual to another has been already considered. There remains for discussion the influence of predisposing causes and favoring conditions that determine the incidence of tubercular disease. Among these influences the constitutional condition of the patient is preëminent. Anæmic, weakly, and unhealthy persons are particularly liable to the invasion of tuberculosis. Their tissues possess little power of resistance to the entrance of the parasite. Such constitutional weakness may be either inherited from feeble parents who were themselves the victims of syphilis, cancer, or other chronic disease, or it may be an acquired predisposition. The offspring of elderly people are also more liable than others to become the victims of pulmonary disease.

An originally healthy organism may become undermined by starvation, or by exposure to bodily and mental causes of exhaustion and disease. In this way consumption may successfully invade a patient who has been exhausted by dissipation, poverty, anæmia, and defective nutrition or wasting discharges. Inflammatory diseases of the respiratory organs often afford an opportunity for the entrance of the tubercle bacillus. Pulmonary consumption is frequently observed after catarrhal bronchitis or inflammation of the lungs. It sometimes follows an attack of serous pleurisy, though in such cases the pleurisy may be the consequence of previous tubercular infection. The inhalation of dust, especially in the form of irritating particles of a metallic or mineral character, such as certain artisans are compelled to inhale, is a common predisposing cause of pulmonary tuberculosis. Wounds and injuries of every kind that involve the thorax and its contents are liable to be followed by tuberculosis.

The *mortality* from consumption is, among children, greatest between the fifth and tenth years of life; and it exhibits a steady increase with every advance in age. Both sexes are about equally liable to the disease, though in some countries the mortality is greater among one sex than among the other—a fact that is probably controlled by habits of

life and the relative degree of confinement in crowded and ill-ventilated habitations. The great influence of this cause is shown by the fact that pulmonary consumption is preëminently a disease that accompanies poverty. It is common among artisans, mechanics, and sewing-women who labor in close and ill-ventilated factories. It frequently occurs in prisons, almshouses, and other institutions where the inmates are confined within narrow limits. Climatic influences are less important than the degree of elevation above the sea-level; though a dry, cool, bracing, equable climate is undoubtedly more favorable to health than one that is damp, warm, and variable. Above the level of 2000 feet pulmonary consumption rarely occurs, and the inhabitants of such elevated regions not unfrequently become rapidly consumptive if they migrate to a lower level. It is doubtful whether racial peculiarities exert any very conspicuous influence that can be compared with the habits of life and the environment of the individual.

It was formerly supposed that malarial diseases, cancer, and many other maladies were incompatible with the development of pulmonary consumption, but this opinion has proved to be erroneous.

Symptoms. *Pulmonary consumption* usually develops in a very tardy and insidious manner, so that the diagnosis may be for a long time exceedingly doubtful. In many instances the disease originates in chlorosis; such cases, if females, often exhibit disorders of menstruation. The presence of scrofulous indications of hereditary predisposition to pulmonary disease should awaken suspicion, especially if the ordinary treatment of anæmia should prove ineffectual. Sometimes the earliest symptoms of consumption are confined to an inexplicable loss of appetite and power of assimilation, accompanied by a tendency to apparently causeless paroxysms of fever. In other cases the symptoms of gastro-intestinal catarrh alone attract attention, until at last the lungs are evidently involved.

Sometimes the catarrhal symptoms are manifested in the larynx and other respiratory mucous membranes. In such cases the evidences of catarrh become more and more evident at the apices of the lungs, and, finally, unmistakable evidence of infiltration can be discovered. A tendency to repeated hæmoptysis forms another early symptom of consumption which may be sometimes observed for years before the final demonstration of actual tuberculosis.

The occurrence of pneumonia in feeble and debilitated patients is often observed as a preliminary step toward pulmonary disease. Especially unfavorable is the presence of inflammation in the upper lobes of the lungs. In like manner the existence of a dry pleurisy in the upper portion of the thorax, and tedious or insidious effusions of a serous character into the pleural cavities, are frequently dependent upon a latent tubercular process. In other cases the occurrence of tuberculosis in the bones, joints, rectum, or uro-genital apparatus is accompanied by a simultaneous or secondary development of the disease in the lungs.

The existence of an hereditary or congenital predisposition to consumption is frequently indicated by the physical conformation of the body. So characteristic are the appearances which indicate this tendency that they can scarcely fail to be detected by the practised eye.

The patient is usually tall and slender, with a long and graceful neck; the skin is thin, delicate, and pale; the muscles are small and flabby; the bones are light, and the skeleton is slightly constructed; the hair is usually fine and silky; the eyes are sunken and surrounded with dark circles; the sclerotic coat is of an extraordinary bluish whiteness, like that of skimmed milk; the cheeks are hollow; the bones of the face are prominent; the whiteness of the teeth matches that of the eyeballs, and they are disposed to early decay. (Fig. 78.) The thorax is

FIG. 78.



Pulmonary consumption. (RUSH MEDICAL COLLEGE CLINIC.)

usually long and flat, the intercostal spaces are consequently broad and deep; the articulation between the manubrium and the body of the sternum is exceedingly prominent; the supra- and infra-clavicular fossæ are unusually depressed, in consequence of the absence of subcutaneous fat, and the lack of muscular volume; the shoulders hang forward, and there is a marked disposition to assume a stooping posture; the scapulæ project like rudimentary wings from the dorsal surface of the body; the extremities of the fingers are often bulbous, and the nails are incurved, like claws, by reason of the absorption of the subcutaneous fat.

The vasomotor nervous system is usually very excitable in consumptive patients. They blush easily, and a slight febrile movement is sufficient to produce a brilliant flush upon the cheeks, constituting the well-known hectic flush that is so conspicuous during the evening

hours. Sometimes this appears only upon the side of the face that corresponds to the affected portion of the lungs.

In many cases the existence of a characteristic cachexia is indicated by the appearance of brown patches in the skin of the forehead or upper portion of the cheeks (chloasma phthisicorum). A similar pigmentation of the skin is sometimes diffused quite generally over the surface of the body. It has been asserted that in these cases the spleen and the lymph glands are extensively diseased, and that hæmoptysis rarely occurs. This pigmentation of the skin must not be confounded with the patches of *pityriasis versicolor* that sometimes develop upon the surface of the thorax as a consequence of the growth of the parasite *microsporon furfur*. These vegetations, and others of a similar nature, are favored by the occurrence of copious perspiration which is so often a prominent feature in the hectic fever of consumption. For the same reason eruptions of miliaria or sudamina are frequently observed.

The cause of phthisical sweating is not well understood. The symptom is frequently connected with fever, but it often occurs without any previous febrile movement. It is usually experienced during the night, especially during the early morning hours, and is often accompanied by a disagreeable odor that is due to the presence of various fatty acids. Occasionally the perspiration is limited to one-half of the body, and prevails upon the side that corresponds to the affected lung.

The course of the disease is usually characterized by great loss of flesh and weight. The fat is absorbed from every part of the body, and all the tissues become pale and anæmic. But sometimes, in spite of advanced pulmonary disease, subcutaneous fat may be preserved in considerable amount. During the latest stage of the disease the lower extremities frequently become œdematous, either as a consequence of complicating nephritis, or as the simple result of anæmia and cachexia. Occasionally it is conditioned by the formation of thrombi in the veins. Sometimes bedsores are developed over the points of greatest pressure, when the patient has been confined long in bed. There is great difference in the duration of such confinement; some patients are able to get up, and to occupy themselves in various ways until the latest period of the disease is reached, while others are compelled to remain in bed for months, or even for years before they are released by death. The position that is assumed by the recumbent sufferer depends very much upon the respiratory capacity of the remaining portions of the lungs. Dyspnœa compels an attitude with the head and shoulders elevated. The existence of pleurisy generally renders it necessary to lie upon the comparatively healthy side, since pressure upon the inflamed portions of the pleural membrane causes pain.

The *intellectual faculties* usually remain unclouded to the last. Sometimes the action of the brain is remarkably clear and vigorous. The patient continues bright, cheerful, and hopeful with regard to the future. Delirium rarely occurs except in the latest stage of the disease.

Pulmonary consumption is almost always accompanied by *fever*. Sometimes the febrile movement is very slight, but when purulent cavities have formed in the lungs, and the products of suppuration are

absorbed into the general circulation, the symptoms of hectic fever often become very marked. The fever usually rises during the afternoon and evening, but sometimes the highest temperature is observed in the morning. Persistent fever usually occurs in cases of quick consumption. The pulse is generally rapid and feeble, but exhibits no characteristic peculiarities.

In many cases the progress of the disease is so gradual, and the necessities of the organism are so completely adjusted to the situation, that dyspnœa is not experienced. But, when acute bronchitis or high fever complicates the disease, the difficulty of respiration may become very pronounced.

The local changes that take place in the lungs usually commence in their upper portions, and are sometimes restricted to the apices. It is supposed that the tubercle bacilli find in these regions the most favorable situation for their multiplication, since the upper part of the thorax is less movable than its other portions, so that the circulation of air and blood is comparatively sluggish in the pulmonary apices. Among the earliest symptoms of disease in these localities are circumscribed catarrh of the bronchi, rough and interrupted vesicular respiration, prolongation of the expiratory sound, and a notable difference between the respiratory murmurs upon the two sides of the thorax. Sometimes a fine crepitant râle or other moist râles can be distinctly heard, especially at the end of a deep inspiratory movement. Associated with these symptoms may be often observed a diminution in the extent of the respiratory movements. If this be not always visible, it may be frequently detected by laying the palm of the hand over the upper part of the thorax. Any considerable disease of the upper portion of the lung is attended by its retraction and by corresponding depression of the thoracic wall. Such collapse is often very conspicuous on inspection. Especially significant is the existence of a considerable difference between the two sides of the thorax. Percussion over the region of depression will then indicate a certain amount of dulness, of which the extent and intensity corresponds with the amount of infiltration that has taken place. It must not be forgotten, however, that on account of the larger development of the right pectoral muscle a greater degree of dulness is often perceptible below the right clavicle than below the left.

Infiltration of the *pulmonary tissue* is indicated by increased vocal fremitus, dulness on percussion, bronchial breathing, bronchophony, and bronchial râles. When caseous masses have softened and have broken down into cavernous hollows, the physical signs will depend largely on the condition and location of the cavity or cavities that are thus formed. The symptoms are most conspicuous when a cavern occupies a portion of the lung near its external surface. If such a cavity be filled with purulent liquid, it yields a dull sound on percussion, but when it is occupied chiefly by atmospheric air, percussion elicits a resonant sound, which assumes a tympanitic character if the diameter of the cavern is not less than two or three inches. When the cavern communicates freely with the external air, a cracked-pot sound may be easily elicited on percussion while the mouth of the patient is open.

Vocal fremitus and bronchophony are under such circumstances increased. Occasionally a succussion sound may be elicited by shaking the patient, and a sound like that of dropping water can sometimes be heard. These phenomena only occur when air and liquid are both present in the cavern.

The *character of the sputa* possesses greater significance in pulmonary consumption than in any other disease of the lungs, since the demonstration of tubercle bacilli affords the means of a positive diagnosis. But it sometimes happens that the bacilli may be for a considerable time absent from the sputa in undoubtedly phthisical cases, because the infiltrated mass in which they are contained has not yet broken down and contributed anything to the expectoration. The number of bacilli in the sputa is subject to great variations from day to day, but generally the more acute the tubercular process in the lungs, the greater their number in the expectoration.

Careful observation of the sputa sometimes results in the discovery of delicate elastic fibres derived from the pulmonary tissue (Fig. 79).

FIG. 79.



Elastic fibres of lung tissue obtained from sputa after digestion in caustic soda. (Drawn by DR. JOHN WILSON.)

These are less conspicuous than the fragments of pulmonary substance that are expectorated during the course of gangrene and abscess of the lung. Degenerated epithelial cells from the alveolar passages are very frequently present, but their diagnostic significance possesses comparatively little importance. Occasionally small calcareous masses are voided in the sputa. These sometimes are derived from bronchial glands that have undergone calcareous degeneration; and in other cases they represent a similar process in the pulmonary tissue itself. When disease of the spine or of the ribs complicates the case, osseous fragments may occasionally find their way into the sputa.

The *form* and *general appearance of the sputum* manifest considerable variability. At first the slimy and transparent mass closely resembles the ordinary sputum of bronchitis. Sometimes it assumes a jelly-like appearance, and if pneumonic inflammation of a chronic character complicates the tubercular process, the expectorated matters exhibit a greenish tinge. When suppuration commences in the pul-

ıary substance the sputa contain more or less pus, and when a cavern ormed in the lungs its contents are frequently discharged in the ı of rounded spheres or partially flattened discs. When associated ı numerous air-bubbles in the expectoration, these masses float in er, but when freed from such support, they rapidly sink to the tom of the vessel into which they have been discharged.

The amount and the character of the *cough* by which expectoration ccomplished depend largely upon the extent to which the bronchi involved in the disease. In some cases cough is scarcely noticeable, ile in others a copious discharge into the bronchi excites irritation l harassing efforts for the discharge of sputa.

The *heart* is frequently disturbed by the course of pulmonary con- nption. Obstruction to the passage of blood through the pulmonary ery causes an accentuation of the diastolic sound at the entrance of artery, and a metallic resonance is imparted to the cardiac sounds large caverns form in the immediate vicinity of the organ. Occa- nally the heart may be displaced by retraction of the pulmonary ostance.

The *urine* exhibits no uniform or characteristic changes. It is ıally diminished in quantity, and its constituents are in like manner ierally reduced. In advanced cases traces of albumin are frequently sent; and occasionally sugar may be discovered.

The *complications* of pulmonary consumption are exceedingly ıerous, since every organ and tissue suffers in structure and func- , either directly from secondary infection, or indirectly from lack of ition.

ıpus sometimes develops upon the skin. The *bones* become in- ed by the tubercular process. The *joints* are not unfrequently cked by an inflammation that owes its characteristic course and ological appearances to the tubercular infection. In advanced s of consumption the *muscles* frequently exhibit an exaggerated ability. A sudden tap upon the biceps, or other conspicuous mus- is immediately followed by a local swelling of the muscular fibres h persists for a number of seconds. This appearance is not pecu- to consumption alone, though it is frequently exhibited most ninently upon the side of the body that corresponds to the affected . In certain cases a peristaltic wave may be seen to traverse the nt of the muscle from the point where it was tapped to its extremi- This phenomenon is also observed in other conditions of general tration, anæmia, and innutrition.

he peripheral *lymph glands* sometimes undergo tubercular inflam- on at the same time that the lungs are invaded. They are liable uppuration followed by the formation of chronic fistulous openings ugh the external surface.

n many cases the *larynx* becomes involved in the disease. The al existence of laryngeal tuberculosis is often preceded by hoarse- and difficulty of articulation, that are dependent upon enfeeble- t and more or less complete paralysis of the laryngeal nerves muscles. Similar inflammatory processes are often developed in trachea and bronchi. The occurrence of *hæmoptysis* as an early

symptom of pulmonary consumption has been already noted, but the presence of a bloody stain in the expectoration does not necessarily condemn the patient to consumption, unless the characteristic bacilli are also present. In such cases the bloody discharge proceeds from a capillary oozing into the alveolar passages. Of a different character is the hæmoptysis that occurs at an advanced stage in the course of the disease, through the formation of caverns in whose walls the rupture of aneurismal dilatations gives origin to a copious flow of arterial blood. The frequency of such an event, however, is not so great as it has been ordinarily estimated. Hæmoptysis occurs in scarcely 25 per cent. of the cases of pulmonary tuberculosis.

The act of *expectoration* is attended with considerable difficulty at the commencement of the disease; but as it advances, and the lungs become more extensively invaded, sputa are discharged with less difficulty. *Gangrene* of the lungs rarely occurs, though if for any reason the sputa are retained in the air-passages, they soon exhale a fetid odor.

The occurrence of *pleurisy* as a complication of pulmonary consumption is a very common event. It may exhibit all the different varieties of the disease; it is liable to remissions and exacerbations, and is sometimes quite transient in its duration. *Pneumothorax* is a much more rare event.

Pericarditis is one of the rarer complications of consumption. It is sometimes of tubercular character. *Thrombi* sometimes form in the heart, or in the pulmonary arteries and veins, leading to the occurrence of peripheral *embolism* in the arterial system.

Digestive disorders are exceedingly common. In many cases these are accompanied by loss of appetite and an unconquerable aversion to food, a fact that renders doubly difficult the treatment of the patient. Sometimes obstinate vomiting or diarrhœa are present, which appear to be of a functional character. In advanced cases of disease the weakness of the muscular coats of the alimentary canal, and the deficiency of hydrochloric acid in the gastric juice, may account for a large portion of the digestive disturbances that exist. In many cases a catarrhal stomatitis adds to the discomfort of the patient, and sometimes aphthous ulcerations exist in the mouth. Numerous parasites, under such circumstances, proliferate in the oral cavity if great care be not taken for its proper cleansing and disinfection. Tuberculous ulcers occasionally form upon the tongue, but they are more frequent in the throat, where they often excite great pain and difficulty in swallowing.

The *function of the intestines* is frequently disordered. Alternate constipation and diarrhœa occur during the early stages of the disease; and when in its later course tubercular ulcerations or amyloid degeneration have invaded the intestinal tract, obstinate diarrhœa persists until the close of life. These disorders are sometimes unattended by any considerable pain, but in other cases they are accompanied by great distress. The favorite seat of ulceration is in the right iliac fossa. Sometimes fragments of necrotic tissue may be discovered in the stools, and in certain cases there may be extensive ulceration, though the bowels remain constipated. Hemorrhage from such ulcers rarely

occur, since the gradual development of the process is attended by occlusion and obliteration of the neighboring vessels. Bleeding is for this reason more liable to occur from the surface of small and recent ulcerations. In many cases the existence of a small intestinal ulcer leads to peritonitis, either through the extension of the inflammation to the peritoneum, or by reason of perforation of the intestinal wall. The occurrence of rectal fistula is generally dependent upon a tubercular process. Not without some degree of justification was the opinion of the older physicians that the cure of such a fistula was liable to be followed by a transfer of the disease from the rectum to the lungs.

The *liver* is sometimes enlarged, and may undergo fatty degeneration, amyloid degeneration, or passive hyperæmia from stagnation of the blood current. Similar enlargements of the *spleen* are not uncommon, though it is sometimes enlarged by infiltration with caseous masses.

In the male sex tubercular inflammation and caseous degeneration are not uncommon in the *testicle* and *epididymis*, where the deposit may be recognized in the form of hard and irregular masses. Sexual appetite frequently remains active, though the general health and vigor of the patient be greatly depressed. Among women, early disorder of menstruation is often manifested. The menses are scanty, irregular, and finally suppressed. The occurrence of pregnancy is usually accompanied by great increase in the activity of the disease.

The *urine* frequently contains albumin, which, when present in small quantities, merely indicates the existence of cachexia; but in actual renal disease, casts and a considerable amount of albumin may be discovered. Sometimes the urine contains pus which is derived from tubercular abscesses in the course of the urinary tract.

The occurrence of the symptoms of *nervous disturbance* adds greatly the unfavorable character of the prognosis, since tubercular meningitis or suppurative meningitis sometimes exists as a consequence of an extension of the tubercular process to the membranes of the brain.

In certain cases there is great complaint of *pain*, which may be caused either by pleurisy or by muscular soreness. These muscular pains are sometimes excited by over-exertion in the act of coughing, but they are sometimes intermittent, and apparently dependent upon peripheral neuritis involving the muscular branches of the nerves.

Insomnia is a not uncommon incident in the course of pulmonary consumption, even though the cough be very trifling and not troublesome at night.

Pulmonary tuberculosis is a chronic disease. According to the statistics collected by Williams, the average *duration of life* after the commencement of the disease is seven and a half years. Sometimes, however, the process is completed in a few weeks. Such cases constitute what is termed quick consumption. They are most frequently observed among young people. Sometimes a chronic case suddenly assumes an acutely progressive character that leads rapidly to a fatal termination. This result is sometimes dependent upon the intercurrence of an acute pneumonia or other extensive and violent form of inflammation, but it is not unfrequently consequent upon the occurrence

of acute miliary tuberculosis that becomes generally diffused throughout the organs of the body.

That consumption is not invariably fatal has been repeatedly shown by the results of post-mortem examination of the lungs of persons who have died of other diseases, after having manifested, many years previously, the symptoms of pulmonary tuberculosis. In such cases the seat of former disease is indicated by retraction of the pulmonary substance, and the existence of cicatricial tissue that frequently contains a calcareous nodule at its centre. In such cases the healing process had been complete, but in many instances only partial recovery occurs, or complete recovery is followed by fresh infection in other portions of the organism, so that the patient remains a chronic invalid.

In fatal cases *death* may result from gradual exhaustion, or it may occur suddenly from violent hæmoptysis, or from œdema of the glottis. Sometimes death results from slow starvation, caused by the difficulty of swallowing, or by the impossibility of digestion and absorption. Death may also result from various complications within the thorax producing dyspnœa and suffocation. Sometimes it is consequent upon embolism or thrombosis. Occasionally it is preceded by the symptoms of general anasarca. In a certain number of cases, however, death occurs without any other apparent cause than complete exhaustion of the nervous system.

Pathological Anatomy. The most characteristic pathological appearance in the lungs is furnished by the presence of cheesy masses in the lung tissue, which are produced by caseous degeneration of the products of inflammation that has been excited by the secretions of the parasitic bacilli. These microörganisms are most abundant in the recent products of exudation, though their spores are numerous in old caseous masses where the bacilli themselves are seldom found. Occasionally an entire lobe of the lung is infiltrated with a cheesy, tubercular mass, but generally the caseous deposits are lobular in their dimensions, and are separated from one another by indurated, slate-colored septa of inflammatory connective tissue. The single lobular infiltrations scarcely exceed the size of a pin's head, but by their fusion large and homogeneous masses of degenerated tubercular deposit are formed. Such caseous masses may undergo calcareous infiltration, and by a species of capsulation the chalky deposit becomes isolated from the remaining lung tissue, and may thus exist indefinitely without doing any harm. But frequently a suppurative process is set up around the concretion, which is finally loosened from its bed, and is discharged with the sputa. When such calcareous infiltration does not take place, the cheesy mass is usually softened by the occurrence of suppuration about its periphery. The deposit is invaded by pyogenic bacteria, and is finally dissolved and removed with the contents of the abscess that is thus produced. In this way pulmonary caverns are developed. Their contents are generally evacuated into an adjacent bronchial tube. Such cavities frequently coalesce, and gradually work their way toward the periphery; occasionally they rupture into the pleural cavity or into the pericardium, unless their progress is restricted by the formation of a zone of chronic pneumonia in the connective tissue that surrounds the cavity.

caverns are frequently lined by a smooth surface that sometimes puts forth granulations that contract and finally accomplish the obliteration of the cavity.

The pulmonary *bloodvessels* which are exposed in the formation of such cavities exhibit a remarkable degree of resistance to the necrotic process. It is not unusual to see large bloodvessels lying exposed in a cavern of considerable size, sometimes crossing independently from one side to the other without any support whatever. The walls of a vomica usually exhibit large bloodvessels, partially exposed and projecting into the vacant space. Sometimes such vessels exhibit aneurismal dilatations which, by their rupture, occasion the profuse and dangerous hemorrhages that are experienced during the later stages of consumption.

The *bronchi* sometimes become excessively dilated, forming cavities that in many respects resemble the caverns that are formed by erosions of the pulmonary substance. Such dilatations may be recognized by their epithelial lining, and by their continuity with a bronchus which may be followed into the dilated space.

In the vicinity of caseous deposits, minute tubercles may be frequently discovered in the course of the lymphatic vessels, constituting a local deposit in the vicinity of older infiltrations. In other cases similar miliary tubercles are universally disseminated throughout the lungs and other organs of the body.

Besides the changes that exist in the lungs *pleuritic inflammation* is usually observed. This may be limited to the upper portion of the lungs, or it may extend to the whole pulmonary membrane.

There has been much discussion regarding the origin of the tubercular process in the lungs. Some authors have maintained that it commences within the minute bronchi, while others insist that it originates within the alveolar passages and air cells. Others again defend the inter-alveolar origin of the disease. It is probable, however, that the process being dependent upon an invasion by the tubercle bacillus, the point of commencement of parasitic activity is determined by the mode of its introduction. When the contagion enters the lungs by inspiration, the favorite seat of the tubercular process is found in the walls of the terminal bronchioles and alveolar passages. But when the contagion enters the lungs from other organs of the body, the bacilli will be found in the inter-alveolar spaces and in the lymph and bloodvessels. When the walls of the bloodvessels are attacked by the infective bacilli, hemorrhagic oozing takes place, and the phenomenon of early hæmoptysis is witnessed. When the air cells are first invaded, the symptoms of catarrhal or desquamative pneumonia may introduce the process. It is probable that in the majority of cases the terminal bronchioles, the alveolar passages, and the walls of the air cells afford the first resting place for the bacilli, and that in their immediate periphery the tubercular process is initiated.

Outside of the pulmonary organs the pathological changes that are not directly dependent upon the tubercular process are merely those which are characteristic of general anæmia and marasmus.

Diagnosis. The diagnosis of consumption is easy when tubercle

bacilli can be discovered in the sputa. In all cases of suspected pulmonary disease careful search should be made for their existence. Sometimes, however, they are absent for a time, though tuberculosis may exist. Repeated examination will finally result in their discovery. In this way the nature of early hæmoptysis may be frequently determined, and the character of the catarrhal bronchitis involving the apex of the lungs may be explained. It must not be forgotten that bronchitis in that locality does not always indicate the existence of pulmonary tuberculosis, since it may be excited by other causes. In the absence of bacillary sputa, the history of the case, the existence of scrofula in early life, and the physical signs must be considered in order to arrive at a conclusion. The existence of hectic fever and progressive emaciation without other assignable cause, are valuable indications of pulmonary consumption. When the physical signs of pulmonary infiltration are discovered, it becomes necessary to differentiate them from the similar signs that are observed in pneumonia. Tubercular infiltration usually commences in the apex of the lung, and when both lungs are thus infiltrated the probabilities are decidedly in favor of consumption. An acute and rapid course of the disease, followed by subsidence of fever and disappearance of physical signs, is indicative of pneumonia.

Tubercular caverns can be differentiated from the cavities that are produced in pulmonary gangrene by the absence of the odor of putrefaction from the matter that is expectorated. The cavities that result from bronchiectasis are usually situated in the inferior and posterior portions of the lungs. The discharge from a pulmonary abscess contains fragments of lung tissue and crystals of hæmatoidin.

PROGNOSIS. The prognosis in the majority of cases is exceedingly unfavorable. When the patient is in such circumstances of affluence that he can seek a favored climate and a healthy locality where a life of ease can be enjoyed, the disease may be hindered in its course, or even entirely cured; but in the ordinary conditions of poverty and misery pulmonary consumption is almost invariably fatal. The disease is liable to assume a rapidly progressive character among young people. The dangers are also greatly aggravated by hereditary influences. Entrance upon the marriage state, and the occurrence of pregnancy are conditions that operate unfavorably upon the course of the disease. When the lungs are extensively consumed and undermined by cavernous abscesses very little hope of recovery can be entertained, and it need hardly be added that the intercurrence of other diseases adds greatly to the dangers of consumption.

TREATMENT. *Prophylactic measures* against pulmonary consumption are more effectual than the treatment of the disease itself. Since its occurrence is largely dependent upon the conditions that accompany poverty, the greatest benefit may be anticipated from every improvement that can be effected in the habitations, workshops, and abiding places of the laboring classes. When the children of weakly or phthisical parents enter the world, they should become at once the objects of forethought and scientific nurture. Consumptive mothers should not nurse their offspring, and if a healthy wet-nurse cannot be provided the

infant should be fed with milk from a healthy cow. It is often better to use a mixture of milk that is furnished by many cows, since it has been shown that sufficient dilution of milk from a tubercular source renders it innocuous. Boiling the milk should not be neglected, since in that way the tubercle bacilli may be effectually destroyed. As children who have inherited a predisposition to consumption advance in years they should be warmly clad and should take abundant exercise in the open air; should be accustomed to gymnastic exercises, and should not be unduly urged in their studies at school. Their diet should be wholesome and sufficient; their hours of sleep unbroken and regular, and they should be trained to the use of cold sponge baths, with plenty of friction upon the skin. Any disorder of the respiratory organs should receive prompt attention, in order to prevent those conditions that favor the entrance of tubercle bacilli. Such precautions are especially needful in connection with the ordinary infective diseases of childhood. The marriage of phthisically disposed individuals is in all respects undesirable, since it favors the manifestation of tuberculosis, if not already present, and is exceedingly liable to aggravate its course if that has been actually commenced. Especially unfortunate is the union of a healthy person with a consumptive partner, since the contagion may be sometimes communicated by one to the other. This is particularly liable to occur when habits of cleanliness are not scrupulously observed, and when sputa containing tubercle bacilli are permitted to dry and mingle with the atmosphere of the residence. For this reason the sputa of consumptive patients should always be received in a covered vessel that contains water, which should be carefully cleansed before the expectorated matter has an opportunity to become dry and pulverulent. If possible, the sputa should be disinfected with a 5 per cent. solution of carbolic acid. Spitting upon the floor and into handkerchiefs should never be permitted. Since the saliva sometimes contains tubercle bacilli, kissing and caressing of a consumptive patient should be strictly forbidden. If these simple precautions be avoided, the danger of direct infection becomes very slight.

It is especially desirable that the apartments in which consumptive persons dwell should be freely illuminated by the sun, since it has been shown that the bacilli rapidly lose their vitality in the rays of sunlight. Abundant ventilation and frequent disinfection of such apartments should also be practised. The influence of climate upon the course of consumption is unmistakable when the disease is thus opposed in its early stages. In the later period of its course the most favorable climatic influences accomplish very little. In order to secure the best results the climate must be dry, mild, bracing, and equable. The atmosphere of the locality should be free from dust, smoke, and other impurities that prevail upon the lower levels of the continent. For this reason the mountainous and wooded regions of the country are preferable to the districts along the seacoast or in the great interior valleys. The purity of the air over the ocean at a distance from land, renders a sea-voyage in the temperate and tropical zones exceedingly desirable for such patients as can endure the discomforts of a long voyage and removal from home. Residence upon small islands in the midst of the

ocean affords an admirable means of securing the advantages of sea-air; and, frequently, when such islands are mountainous, the concurrent advantages of elevation above the sea-level can be also enjoyed. For this reason the island groups along the western coast of Africa, and the Sandwich Islands, in the Pacific Ocean, afford an ideal refuge for consumptive patients. The Island of Nassau, among the Bahamas, is also an excellent place of resort, though its lack of mountainous elevation renders it inferior to the high islands of the Atlantic and of the Pacific. Within the limits of the American Continent, the territories of Arizona, New Mexico, and the States of Colorado and California afford the best opportunity for securing the advantages of dry, pure air; but unfortunately the distance of these resorts from the centres of population, and the lack of sufficient accommodation, render them less accessible and desirable than they will be at some future period. The Adirondack Mountains in New York, and the mountain resorts among the Alleghenies in Pennsylvania, Maryland, Virginia, North Carolina, Kentucky, and Tennessee, are at present the most accessible and salutary places of residence that possess any considerable reputation. The climate o Florida and of the coast of the Gulf of Mexico is exceedingly agreeable during the winter months of the year, but it lacks the bracin quality that is needful for the invigoration and reconstitution of debilitated invalid. The highlands of Mexico and of Southern Ca fornia possess a well-deserved reputation, but even there, as elsewhe there is a great opportunity for choice between different localities, much depends upon local conditions by which are determined the re tive dryness and salubrity of any given situation. For this reason, t dry, cold, bracing winter weather of the northern lakes and of t States around the head waters of the Mississippi and Missouri rivers, often to be preferred to the mild and relaxing atmosphere of southe latitudes. Only when a patient cannot endure the severity of a nor ern winter, and is thereby unable to obtain exercise in the open during that season of the year, should he be advised to seek a reside near the Gulf of Mexico or upon the Pacific slope. But, under no cumstances, should a patient who is far advanced in consumption, wh lungs are riddled with cavities, and who is liable to rapid exhausti and sudden death, be advised to leave a comfortable home, in the v hope of recovery in a distant and untried resort. Especially injuri is the rapid removal to an elevated residence several thousand f above the sea-level, since under such circumstances an extensively in trated lung cannot easily adapt itself to the necessities of respiration an attenuated atmosphere. Pulmonary hemorrhage is also to be fea under such conditions. Hemorrhagic cases should seek the level of shore, rather than a mountainous elevation.

The diet of the consumptive patient should receive the greatest att tion. During the early stages of the disease, before the formatio extensive cavities in the lungs, great benefit may be derived from Weir Mitchell method of feeding, combined with rest and massage. advanced cases of the disease the condition is virtually that of s starvation, hence dietetic measures are of the greatest importance. unconquerable disgust for food that sometimes exists may render c

pulsory feeding an absolute necessity. Milk, eggs, cocoa, chocolate, the tenderest meats, bread, butter, cream, wine, beer, extract of malt, rich broths, and well-made soups should be abundantly furnished. In many cases a luncheon should be supplied between the regular meals, and a glass of milk or of good beer should be taken on retiring at night. Cod-liver oil is of great value as a means of hindering the progress of emaciation. It should be given after meals in the largest dose that can be tolerated by the stomach, and some other vehicle rather than whiskey should be chosen, since alcohol increases the existing gastric catarrh. Sometimes it is necessary to commence with single-drop doses, which are to be gradually increased as the stomach becomes tolerant of the oil.

For the relief of cough, narcotics and expectorants are necessary.

℞.—Morph. sulph. gr. iij.
Spt. chloroform.
Tr. cannab. ind. } āā ʒj.
Acid. hydrocyan. dilut.
Tr. hyoscyam. ʒij.
Acid. phosph. dilut. ʒiij.
Syr. ipecac. } āā ʒvj.
Syr. scillæ }
Glycerini ʒiijss.—M.

S.—A teaspoonful every four hours.

If it be desirable to omit syrup from the combination, an aqueous solution of apomorphine may be substituted for the syrups of ipecac and squills.

℞.—Morph. sulph. gr. j–ij.
Acid. hydrocyan. dilut. ʒj.
Syr. tolut. ʒxv.
Aquæ ʒij.—M.

S.—A teaspoonful every four hours.

It is, however, desirable to avoid any considerable use of opiates, since they impair the appetite, and the length of the disease may render the use of large doses necessary before its conclusion. When the patient is annoyed by an excessive bronchial secretion, mineral waters that are rich in chloride of sodium may be employed with advantage. In such cases the wine of tar, tar-water, and terpin hydrate are useful. Oxalate of cerium is often beneficial in doses of five to ten grains every four hours. The advance of anæmia may be resisted by the administration of various preparations of iron. The arseniate of iron does good service in many cases. Three drops of Fowler's solution with a tablespoonful of compound iron mixture can be taken three times a day with considerable benefit. Carbonate of iron is another excellent preparation, and the ferrated mineral waters are often very beneficial. Loss of appetite, especially when attended by qualms of nausea, can be often relieved by the administration of bitter tonics.

℞.—Strych. sulph. gr. j.
Quin. sulph. ʒss.
Acid. sulph. arom. ʒj.
Syr. cort. aurant. ʒvij.
Aquæ ʒiij.—M.

S.—A teaspoonful in a wineglass of water before each meal.

The compound tinctures of cinchona and of gentian are useful. For delicate patients the elixir of calisaya bark is a valuable aid.

When hectic fever exists, its paroxysms may be considerably shortened and reduced by the administration of phenacetine or acetanilide in five-grain doses every two hours, at the commencement of the attack. Antipyrine may be also employed if it does not cause nausea and depression of the heart. Copious perspiration can be greatly diminished by the use of atropine. This may be administered in doses of $\frac{1}{100}$ of a grain at bedtime. A pill containing $\frac{1}{4}$ of a grain of extract of belladonna and two grains of oxide of zinc may be taken with benefit for the same purpose. Strychnine has also been administered successfully, and frequent sponge baths with moderately cold water containing alcohol, serve to invigorate the system, and to reduce the tendency to perspiration. A strong decoction of sage, drank cold at night, is not only soothing, but stimulating and antagonistic to perspiration. The treatment of hæmoptysis will be considered in connection with diseases of the lungs.

Many experimental methods of treatment have been recently introduced and as quickly abandoned. Among these may be mentioned the inhalation of hot air, compressed air, rarefied air, and medicated airs. Great hopes were at one time entertained of benefit from the injection of sulphuretted hydrogen into the rectum and intestines, but the effect of this medication was merely that of an anæsthetic, which, for a time, diminished the cough, but did not appreciably affect the progress of the disease. Innumerable other drugs have been prescribed with very indifferent success. In general, it may be said that everything which assists digestion, increases the growth of the blood, and invigorates the health, is of service in retarding the course of the disease, but beyond these indirect influences very little can be expected from ordinary medication.

Very recently, Koch, the discoverer of the tubercle bacillus, introduced a method of treatment by which it was hoped that the proliferation of the specific bacilli in the tissues might be directly antagonized; but after extensive trials, a feeling of general disappointment has succeeded to the enthusiasm with which the experiment was first undertaken. The method consists in the injection, every other day, of a glycerin solution of the products of the tubercle bacillus, obtained by its culture in appropriate media. To the secretions thus gathered and dissolved has been given the name *tuberculin*. The amount of fluid that is injected should not exceed half a milligramme at first. This quantity may be gradually increased, but probably should never exceed one-fifth of a cubic centimetre. The liquid should be diluted with one-half of one per cent. solution of carbolic acid. Every precaution should be taken for the thorough disinfection of the apparatus, and the injections may be made into the subcutaneous areolar tissue just below the shoulder-blade or in the lumbar region, since these parts are least sensitive to the operation. The injection is usually followed by high fever that lasts for several hours, if tuberculosis actually exists in the tissues of the patient. More recent experiments seem to indicate that it is not advisable to operate with doses sufficient to produce such

violent reaction. The treatment must be continued until it is no longer followed by any febrile movement. Usually many months are requisite for its efficient use, and the ordinary hygienic methods are as necessary as they ever were before the introduction of the new method.

Laryngeal Tuberculosis—Phthisis Laryngea.

Etiology. *Laryngeal tuberculosis* includes all those ulcerative processes that occur in the larynx as a consequence of invasion by the tubercle bacillus. The disease occurs more frequently among men than among women, and is especially common between the ages of twenty and thirty years. It is usually associated with pulmonary consumption as a secondary consequence of the infection of the lungs. It is probably due to the migration of bacilli from the lungs into the tissues of the larynx. It is not impossible that a primary infection of the larynx may take place through inspiration of dust containing tubercle bacilli.

Pathological Anatomy. In the vast majority of cases the tubercular process commences in the sub-epithelial tissues of the larynx. Tubercular infiltrations are there formed, and there undergo caseation. The overlying epithelial surface becomes pale, thickened, softened, and finally necrotic. In this way tubercular ulcerations are formed which are variable in size, and which occasionally extend into the trachea, though more frequently into the tissues between the larynx and the base of the tongue. In certain cases the tubercular process commences in the follicles of the laryngeal mucous membrane. (Fig. 80.)

The ulcerative process generally occupies the posterior wall of the larynx, and the mucous membrane upon the posterior extremities of the vocal cords. It also invades the arytenoid cartilages and the epiglottis. By the coalescence of numerous small ulcers, a large portion of the organ may be eroded and rendered useless for vocal utterance. The cartilaginous structures of the larynx may become involved in the process, and fatal œdema sometimes concludes the scene. A tendency to cicatrization and repair of the ulcerated tissues is scarcely ever observed.

Fig. 80.



Laryngeal phthisis, showing destruction of a large portion of the epiglottis and general ulceration. (Morell Mackenzie.)

Symptoms. With the aid of the laryngoscope, the progress of laryngeal tuberculosis may be easily followed. The mucous membrane at first appears swelled, pale, and uneven. These appearances are followed by visible erosion and the ordinary evidences of ulceration. Sometimes a great disproportion may be remarked between the amount of local destruction of tissue and the modifications of the voice. In some cases the voice is lost, though very little ulceration be visible; while in other cases the opposite conditions exist. Great importance undoubtedly must be ascribed to the effects of muscular weakness and mucous swelling.

The majority of patients complain of great uneasiness and irritation

in the throat and in the parts between the pharynx and middle ear. A harassing cough, with muco-purulent and frequently offensive sputa, serves to torment the patient by day and by night. The act of swallowing is often intensely painful, and sometimes the lesions are of such a nature that liquids find their way from the pharynx into the larynx without the possibility of their exclusion. The symptoms of pulmonary consumption also complicate the case in the majority of patients, though occasionally the disease is confined to the larynx alone. Cicatrization and recovery are exceedingly rare events. Death generally occurs as a result of exhaustion, or of suffocation through the sudden development of œdema of the glottis. The prognosis is, of course, most unfavorable.

DIAGNOSIS. With the aid of the laryngoscope for inspection of the larynx, and of the microscope for the examination of the sputa, the diagnosis of laryngeal tuberculosis is quite easy. In order to avoid the error of referring tubercle bacilli from pulmonary sputa to a laryngeal source, it is advisable to procure for microscopical examination a portion of the muco-purulent discharge from the laryngeal ulcer by the introduction of a camel's-hair pencil into the larynx. Guided by the mirror, a sufficient quantity of the secretion may be thus obtained for subsequent examination. In this way a tubercular ulcer may be distinguished from syphilitic ulcerations within the larynx. Greater difficulty is presented by cases in which there exists a combination of laryngeal syphilis with tuberculosis of the larynx and of the lungs. Hypodermic injection of tuberculin has been employed as a diagnostic aid, since, after the injection, the margins of a tubercular ulcer become greatly reddened and swelled; but the operation is not without considerable danger in the way of exciting œdema of the glottis.

TREATMENT. The treatment of laryngeal ulceration is largely surgical, and consists in curetting the ulcers, or in their thorough cauterization with nitrate of silver, creasote, or lactic acid. Various insufflations are recommended for the purpose of stimulating the ulcerated surfaces (iodoform, iodol, menthol, etc.). The hypodermic use of tuberculin in very minute doses has been followed by improvement in many cases, and sometimes by apparent recovery.

When it becomes necessary to fall back upon simple palliative treatment, pain may be relieved by frequent pencilling of the laryngeal cavity with a ten per cent. solution of cocaine. Inhalation of the pulverized vapor of a one per cent. solution of bromide of potassium often gives great relief when there is an irritating cough. Simple inhalations of a one-half of one per cent. solution of carbolic acid, or of liquor aluminii acetici are excellent means of disinfection when the sputa and the breath are offensive.

The occurrence of suffocation from œdema of the glottis, or from the development of great tumefaction within the laryngeal cavity, renders necessary the operation for tracheotomy.

Pharyngeal Tuberculosis—Phthisis Pharyngea.

The etiology and pathological changes of pharyngeal tuberculosis do not differ in any essential particular from those which have been already

described under the head of laryngeal tuberculosis. The cervical lymph glands exhibit a greater tendency to enlargement and induration, since they are intimately connected with the pharyngeal and faucial structures.

SYMPTOMS. The amount of pain and difficulty in swallowing varies greatly in different patients. It is frequently quite out of proportion with the extent and severity of the local lesions. The course of the disease is sometimes very rapid, with extensive diffusion of miliary tuberculosis throughout the body. In other cases the disease progresses slowly, with but little evidence of general excitement. The tongue, the larynx, the œsophagus, and the intestines are very liable to invasion as the disease advances.

DIAGNOSIS. The disease can be readily recognized by the presence of tubercle bacilli in the secretions from the ulcerated surfaces. Without this test it is sometimes quite difficult to distinguish the tubercular ulcer from a syphilitic sore.

TREATMENT. The local treatment of the pharynx consists in the relief of pain by frequent pencilling of the ulcerated surfaces with a four per cent. solution of carbolic acid in glycerin, or a twenty per cent. solution of bromide of potassium in glycerin, or a ten per cent. solution of cocaine. The ulcers should be thoroughly cauterized with the galvano-cautery, or with its substitutes, nitrate of silver, chromic acid, or lactic acid.

Intestinal Tuberculosis—Phthisis Enterica.

ETIOLOGY. Intestinal tuberculosis is, among adults, almost invariably a secondary consequence of pulmonary consumption, the intestinal mucous membrane being invaded by the tubercular contents of the sputa that are swallowed by the patient. Among children who consume the milk of tubercular cows it may exist as a primary disease.

PATHOLOGICAL ANATOMY. The favorite seat of tubercular ulceration in the intestinal wall is the lower portion of the ileum and the upper portion of the colon. The number of ulcers is exceedingly variable, being sometimes very numerous, and in other cases reduced to a single lesion.

The ulcerative process commences in the follicles of the intestine. Both the solitary glands and the agminated may become centres of the process. The follicular elements proliferate, swell, undergo caseation, softening, and evacuation. These stages of the necrotic process are indicated at first by circumscribed swelling, and finally by the formation of deep crater-like ulcers with sharply defined margins, constituting what are called primary intestinal ulcers. As these enlarge they may become confluent, so that in many cases extensive and irregular lesions of substance are visible. They tend to develop along the lymph vessels and bloodvessels which enter the intestine, and, consequently, present an oval form with the long axis parallel to the circumference of the intestine. Sometimes the gut is completely surrounded by a zone of ulceration that has been thus developed. Under the serous investment of the intestine, in the neighborhood of the intestinal ulcers, deposits

of miliary tubercle are frequently observed, and they may be traced to a considerable distance along the course of the lymphatics. Perforation of the intestinal wall rarely occurs, since the base of the ulcer is thickened by exudation that prevents its penetration into the peritoneal cavity. Cicatrization is not often witnessed, though occasionally the gut may be constricted by an old scar. The mesenteric glands usually become infected and greatly enlarged; they frequently undergo caseous degeneration, sometimes suppurate, and may be often recognized as prominent tumors within the abdomen.

SYMPTOMS, DIAGNOSIS, AND PROGNOSIS. Intestinal tuberculosis sometimes exists for a long time without conspicuous symptoms, until microscopical examination of the feces results in the discovery of characteristic tubercle bacilli. But sometimes the disease forcibly arrests attention by the sudden occurrence of most formidable symptoms, such as intestinal hemorrhage, evidences of general or circumscribed peritonitis, symptoms of perforation and collapse, which result from sudden rupture of a bloodvessel or of the intestinal wall.

One of the most characteristic symptoms of intestinal tuberculosis is *diarrhœa*. This is excited by irritation of the intestinal wall, and by a catarrhal condition of the mucous membrane between the ulcerated surfaces. The diarrhœa is especially troublesome during the latter part of the night and in the early morning. The feces are exceedingly offensive, watery, and charged with undigested food. Sometimes, when the ulcerative process is limited to the upper portion of the small intestine, the bowels may be quite constipated. Blood and pus sometimes appear in considerable quantity mixed with the feces, and they can be frequently recognized by the aid of the microscope when not visible to the naked eye. Occasionally fragments of the intestinal wall may be discovered. *Pain* is usually experienced in the abdomen. Sometimes it is absent, but in the majority of cases it occurs either spontaneously or as a result of pressure over the abdominal walls. The most frequent seat of tenderness is in the right iliac fossa, where ulceration is often observed. *Vomiting* is a rare event, unless peritonitis occurs. The *appetite* is usually destroyed, though sometimes it is quite voracious. As a patient becomes emaciated, enlarged *mesenteric glands* and indurated *ulcers* can be often felt through the abdominal wall. The *prognosis* is almost inevitably fatal. *Death* occurs either as a consequence of exhaustion, or through the development of various complications.

TREATMENT. The general treatment that has been recommended for pulmonary consumption is useful in the intestinal form of the disease. The diet should consist principally of milk, koumiss, eggs, broths, and animal food that yields little refuse for the formation of irritating feces. The occurrence of diarrhœa requires the use of opiates and other remedies, as recommended in the treatment of enteric inflammation. Large doses of bismuth subnitrate or of bismuth salicylate may be administered with benefit. If the lower portion of the colon and the rectum are ulcerated, solutions of nitrate of silver (one to five parts per thousand) may be employed in the form of an intestinal injection. The fluid should be conveyed through a long rectal tube above the sigmoid flexure of the colon.

In cases that are complicated by constipation, it is desirable to irri-
te the colon with large quantities of warm water, for the purpose of
moving fecal accumulations that might irritate the ulcerated surfaces.
ntle laxatives may also be administered with advantage. If pain
licts the patient, hypodermic injections of morphine and warm poul-
es should be prescribed.

Tuberculosis of the Kidneys and Urinary Organs—Phthisis Renalis.

ETIOLOGY. *Tuberculosis* of the *kidneys* may occur as a primary
ase, involving the kidneys alone, or extending from them into the
ghboring urinary and sexual organs; or it may occur as a secondary
sequence of pulmonary consumption, or of some other variety of
erculosis. It is often difficult to decide whether the disease occurs
primary or a secondary process; nor is it always possible when it
rimary in its character to trace the avenue of infection by which
tubercle bacilli have entered the kidneys. Far more easy is the
rmination of the manner in which secondary infection of the renal
ns takes place. When the lungs are the seat of primary tubercu-
s, the contagion is transported through the lymphatic canals and the
dvessels. Sometimes the same channels serve to convey contagion
the genital organs to the kidneys. The occurrence of epididymitis
ugh gonorrhœal infection may favor the occurrence of subsequent
ercular infection of the affected organ. From this, tubercle bacilli
be easily transported to the kidneys, where they excite a secondary
ercular process. Similar infection may result from copulation with
bercular person. The bacilli may be contained in the sperm, or in
vaginal fluids.

PATHOLOGICAL ANATOMY. The tubercular process sometimes in-
ves the whole length of the urinary passages, but sometimes it
upies scattered and detached portions of those channels. In certain
es the process ascends from the epididymis through the bladder and
ters to the kidneys, while in other cases a descending course is
erved. Ascending tuberculosis usually affects the kidneys upon the
ne side with the original focus of infection in the epididymis. When
e kidney alone is involved, the other may be completely healthy,
it may exhibit a condition of chronic inflammation.

In the kidneys, the tubercular process commences in the papillæ and
vances toward the cortex of the organ. The usual stages of infiltra-
n, caseation, softening, and evacuation are witnessed, so that the
lney, like the lungs, finally becomes riddled with suppurating cavi-
s. Through coalescence of these cavities the entire kidney may be
ally disorganized, and nothing left but a pus-filled sac, formed by the
ckened capsule of the kidney. The pelvis of the organ is usually
ated in consequence of the obstruction of the ureter and stagnation
urine. In many cases the ureters are themselves involved in the
ercular process, and as a consequence of the obstruction thus pro-
ed they become greatly deformed and distended. The mucous
mbrane of the bladder, especially in the neighborhood of its neck,

very commonly undergoes extensive ulceration, and sometimes the ulcerated surfaces become incrusted with phosphatic salts. When the urethra is ulcerated, the peri-urethral tissues are frequently invaded and infiltrated. Not infrequently perforation of the urinary passages may occur as a consequence of tubercular ulceration. The ordinary consequences of peritoneal perforation are then manifested.

Symptoms and Diagnosis. In many cases the symptoms are identical with those of catarrhal inflammation of the bladder, and only after the microscopical examination of the urinary sediment, and the discovery of tubercle bacilli, is the true nature of the disease rendered manifest.

The urine is often considerably increased in quantity, but its specific gravity usually remains unchanged. The sediment often contains pus and minute caseous masses which are of great significance. When the disease has progressed to a considerable extent, numerous epithelial cells, round cells, and degenerated elements from all parts of the urinary apparatus may be discovered in the urine. Triple phosphates are usually present whenever there is stagnation of urine in the bladder, even though the reaction of the liquid still remains acid. The amount of albumin in the urine is proportionate with the quantity of pus, unless the kidneys are also in a state of inflammation. Under such circumstances the amount of albumin follows the usual rule. Ulceration of the bladder is accompanied by decomposition of the urine, which becomes ammoniacal and exceedingly offensive. Sometimes the urethra is obstructed by fragments of detritus, and there is always great uneasiness and pain in the act of micturition.

When the kidneys are involved in the tubercular process, pain is usually experienced in the region of the organs. Sometimes the suffering is very great, and distress is felt not only in the loins but through the abdomen, in the groins, testicles, and thighs. The pain is sometimes continuous, sometimes intermittent, and in certain cases entirely absent, though it can be generally excited by pressure below the ribs. The enlargement of the kidney sometimes varies in size, and its diminution is frequently accompanied by a copious discharge of urine, indicating a temporary obstruction of the ureter that had finally given way. Such obstruction is sometimes attended by chilliness and fever, consequent upon retention of pus in the pelvis of the kidney. Such purulent accumulations sometimes lead to rupture and external discharge of pus, and under such circumstances the symptoms of abscess and fistula are associated with those of tuberculosis.

Uro-genital tuberculosis is often associated with tuberculosis in other organs. The patient becomes anæmic, and finally dies of exhaustion or from obstinate diarrhœa, miliary tuberculosis, or secondary inflammation of the kidneys.

Prognosis and Treatment. The prospect of recovery is exceedingly small. In very rare instances apparent recovery has been known to occur in cases of primary tuberculosis. Treatment avails little more than to afford partial relief from pain, and to meet the local symptoms as they arise. Irrigation and disinfection of the bladder serve to diminish the amount of suffering that is consequent upon inflammation

d ulceration of that organ. The general treatment of tuberculosis ould be employed; and when abscesses develop in any portion of the ro-genital tract that is accessible, surgical measures become necessary. Then a single kidney alone is involved, it may be removed if enlarged id painful. Incision of the bladder has also been performed for the lief of severe and obstinate ulceration; the cavity of the organ is ien to be treated by drainage and disinfection, like any other extensive bscess.

Miliary Tuberculosis—Tuberculosis Miliaris Disseminata.

Etiology. Generally, *miliary tuberculosis* consists in the wide dif- ision of minute, gray tubercular nodules, of which the growth is xcited by the tubercle bacillus. The disease is usually a secondary onsequence of tubercular infiltration in the lungs or other portion of ie body. From this central point of departure, minute portions con- ining the infective virus are transported through the vascular and mph channels of the body until they find lodgment at a distance from ie point of departure. In this way the dissemination of miliary berculosis resembles the ordinary embolic process by which the terial circulation is obstructed when vegetations break loose from the lves of the heart.

The infective focus may be located in any organ or tissue of the ly. It is sometimes found in an incision or wound that has been ected from without. It has been observed that when caseous masses the lungs are surrounded by a firm capsule of connective tissue, iary tuberculosis seldom occurs. The process is excited by exposure old, and by other disturbing causes that unfavorably influence the lth. Operations upon tubercular bones, the rapid absorption of us effusions after tubercular pleurisy, and active treatment with ections of tuberculin, are sometimes followed by the wide dissemina- n of tubercular virus and the occurrence of miliary tuberculosis.

Pathological Anatomy. *Miliary tuberculosis* occurs more fre- ntly in the *liver* than in any other organ. The *lungs* stand next in er, and after them the *kidneys*, *intestines*, and *spleen*. In the other ans of the body it less frequently occurs. In the stomach, salivary nds, and pancreas, it is scarcely ever observed. In the *lungs* the bercular masses exist in the form of minute nodules which may be t scattered in every portion of the organ, often feeling like small shot the substance of the lung. The *pleural membranes* are frequently volved at the same time. Similar deposits are frequently found in the bstance of the *heart*, in the *pericardium*, and upon the *endocardial mbrane*. The walls of the *veins* frequently exhibit tubercular de- its, and they are sometimes visible in the *arterial coats*.

The *spleen* frequently contains numerous miliary tubercles which en closely resemble the Malpighian bodies, but they can be readily tinguished by the absence of any connection with the bloodvessels, l by the presence of tubercle bacilli that can be easily discovered h the aid of the microscope. In the *kidneys*, miliary tubercles are efly located in the cortical portion. They can be sometimes traced

along the course of particular arterial branches. The *peritoneum* is very often studded with miliary tubercles, producing thickening, adhesion, and contraction of the omentum and peritoneal surfaces. Peritonitis or ascites generally exists in connection with the tubercular deposit. In the *liver* miliary tubercles appear in the interlobular connective tissue and within the lobules themselves. The *meninges* of the *brain* are very commonly invaded by miliary tuberculosis, producing the symptoms of tubercular meningitis.

SYMPTOMS. The symptoms of *miliary tuberculosis* are dependent in part upon general infection of the entire organism, and in part upon local lesions in the individual tissues and organs. The disease is generally accompanied by fever which is variable in its type, being sometimes continuous, sometimes remittent, and sometimes intermittent. In certain cases the period of exacerbation occurs in the morning rather than in the evening. The pulse is usually quite frequent, often reaching 120 or 130 beats per minute. Copious perspiration, eruptions of herpes around the mouth, and roseola over the anterior surface of the body, are frequently observed. Albuminuria and peptonuria are not uncommon. The intellectual functions are frequently disturbed, so that the patient either lies apathetic, delirious, or soporose. Sometimes maniacal excitement is manifested. Two particular types of the disease are recognized, in one of which the symptoms closely resemble those of typhoid fever, while in the other the febrile movement exhibits a well-marked intermittent character. In doubtful cases the diagnosis can be sometimes established by microscopical examination of the blood, since it has been shown that in miliary tuberculosis the bacilli are contained in the blood, especially in that of the spleen. By puncture of the spleen, and withdrawal of a small quantity of blood with the aid of a hypodermic syringe, the presence of tubercle bacilli may be demonstrated.

The local symptoms vary, according to the principal seat of the tubercular process. When the *lungs* are involved, the principal symptom often consists of an obstinate cough that torments the patient and cannot be relieved by narcotics. It is usually attended by pain in the thoracic and abdominal muscles, which become sore through excessive exercise in the act of coughing. If the *bronchial passages* are inflamed, the ordinary symptoms of bronchitis are added. The *sputa* sometimes contain streaks of blood, or may be of a dark-brown color recalling the appearance of pneumonic sputa. Sometimes excessive *dyspnœa* is experienced, and the respiration is greatly hindered without any apparent cause for the disturbance. When such attacks assume a paroxysmal character, they present a considerable likeness to the paroxysms of asthma. Sometimes the attack is accompanied by considerable *cyanosis*, which may reach a high grade of intensity without any apparent cause for the discoloration of the surface.

Sometimes a *tympanitic resonance* is elicited by percussion below the clavicles. This indicates excessive dilatation and tension of the air-cells. Under such circumstances the "cracked-pot sound" is sometimes audible. The sputa do not contain tubercle bacilli unless

miliary process is complicated with ordinary caseous infiltration of the lungs.

Miliary tuberculosis of the *pleural membranes* frequently involves one or both sides of the thorax, and its symptoms are masked by the symptoms of ordinary pleurisy with exudation. In like manner, miliary tuberculosis of the other serous membranes of the body may be overlooked, or considered merely symptomatic of ordinary serous inflammation.

Miliary tuberculosis of the *kidneys* is less than a chronic tubercular infiltration likely to cause the appearance of albumin in the urine; so, also, the appearance of tubercle bacilli in the feces is indicative of chronic tuberculosis rather than of the miliary process.

When miliary tuberculosis is widely diffused, the choroid membrane of the eye is sometimes invaded by gray granulations which can be readily detected with the ophthalmoscope.

The course of miliary tuberculosis is usually very rapid, and speedily reaches a fatal termination. The average duration of the disease is from four to eight weeks, though in certain cases it may be protracted for many months. Death rarely occurs before the end of the second week, and is due sometimes to collapse, or to the development of an excessively high temperature, or dyspnœa, meningitis, dissolution of the blood, and universal hemorrhage, or to other complications involving the vital organs of the body.

Diagnosis. When tubercle bacilli can be discovered in the blood, or when miliary tubercles are visible within the eye, the diagnosis is very certain; but under other circumstances it is frequently attended with considerable doubt and difficulty. The existence of chronic tuberculosis in any portion of the body favors the diagnosis of miliary tuberculosis. When acute symptoms supervene in the catarrhal form of the disease, it differs chiefly from *acute bronchitis* in the greater degree of general prostration that accompanies its course. From *pneumonia* the disease differs in the absence of well-marked consolidation of the lungs, and of the characteristic course of pneumonic inflammation. Rusty sputa are sometimes present in both diseases. *Intermittent fever* exhibits a more clearly defined paroxysm, and yields readily to quinine. From *typhoid fever* the disease differs positively in the character of the infective bacilli. When these can be demonstrated, the diagnosis is certain. It may be also remarked that the course of miliary tuberculosis presents less uniformity than that of typhoid fever. The abdominal distention, diarrhœa, and eruption of typhoid fever are also absent, and bronchitis is usually less conspicuous a symptom in typhoid fever than in miliary tuberculosis. The association of *renal inflammation* with miliary tuberculosis may render very difficult the diagnosis between the symptoms of the miliary process and those of uræmia. When *miliary cancer* invades the lungs, the diagnosis will be aided by the discovery of a primary cancerous tumor, and by a knowledge of the fact that carcinoma and miliary tuberculosis are very rarely associated. Occasionally the stupor and cyanosis that accompany miliary tuberculosis closely resemble the similar symptoms that attend *poisoning with narcotics*. When the course of the disease is unattended

by fever, and is characterized by maniacal excitement, the symptoms might be very easily mistaken for those of *acute mania.*

PROGNOSIS AND TREATMENT. The *prognosis* is always unfavorable, though temporary recovery is sometimes observed. Usually, however, in such cases the symptoms are renewed whenever a fresh diffusion of the tubercular virus takes place. The *treatment* is largely symptomatic, since we possess no means of successfully opposing the course of the disease. Ordinary anti-febrile remedies may be employed for the relief of fever, and narcotics are prescribed to allay pain or to procure sleep. Hypodermic injections of tuberculin seem to be of little value, if they be not actually injurious, since the process of miliary tuberculosis has in certain cases appeared to be excited by this mode of treatment.

Tubercular Meningitis—Meningitis Tuberculosa.

ETIOLOGY. *Tubercular meningitis* is the result of a deposit of miliary tubercles in the meninges of the brain. During the process of infiltration the symptoms are negative. Only when an inflammation is excited by the tubercular process are acute symptoms apparent.

The primary source from which the contagion is derived may exist in caseous lymph glands, in caseous masses deposited in different organs of the body, or in tubercular diseases of the skin, such as lupus.

The disease occurs more commonly among males than among females. It is usually witnessed in children between the second and sixth years of life. It is rarely observed after the age of puberty. Its occurrence is more frequent during the cold months of the year than during the warm weather of summer.

PATHOLOGICAL ANATOMY. The vascular canals of the cranium, meninges, and brain are distended with blood. Sometimes miliary tubercles are visible along the course of the middle meningeal artery, or in the dura mater. The arachnoid surface of the dura mater frequently appears dry, and often exhibits minute points of hemorrhage. The pia mater also appears dry and tarnished. Minute tubercular granulations can be often discovered along the course of its vessels, and sometimes the larger vessels are accompanied by a delicate fringe of purulent exudation.

The principal seat of exudation is located at the base of the brain, between the chiasm, the crura of the cerebrum, and the pons. The course of the Sylvian artery is another favorite seat of tubercular eruption and inflammatory exudation. The exudate is of a jelly-like consistency, and rarely exhibits any considerable serous effusion. It consists chiefly of round cells, pus corpuscles, and coagulable constituents. The tubercular masses are often found in a condition of degeneration and caseation. The convexity of the brain exhibits the effects of pressure; its convolutions are flattened; the sulci are more or less obliterated. The ventricular cavities are frequently distended with fluid of a serous character, sometimes containing flocculi of lymph, but rarely any pus corpuscles. The ventricular surfaces are usually softened, and occasionally exhibit tubercular deposits. Sometimes a puru-

it tubercular inflammation exists in the choroid plexus. The surface the cerebellum is also frequently invaded by a tubercular and inflam- atory process. The disease is not confined to the brain, but frequently vades the spinal cord and its membranes. In certain cases the tuber- lar eruption is circumscribed within narrow limits, and it is then ore likely to invade the left side of the brain than the right.

SYMPTOMS. During the period of tubercular deposit no decisive mptoms are manifested. The patient may exhibit loss of appetite, llor, debility, and depression of spirits. Only when inflammatory nditions exist, or when local compression of certain cerebral nerves sults from infiltration or exudation, is attention attracted to the cere- al disease. The course of inflammation is usually characterized by mptoms that are identical with those which attend the evolution of dinary serous or purulent meningitis; but the duration of the disease often much more protracted in tuberculosis than in cases of ordinary flammation, consequently the symptoms of tubercular meningitis suc- ed one another more gradually than in the non-tubercular forms of flammation. Tubercular meningitis is also sometimes characterized y remissions, during which an apparent recovery takes place; only, owever, to be followed at a later date by a renewal of the symptoms.

The *prodromic period* of the disease is correspondent with the process f tubercular deposit. During this period there is evident disorder of he health. The little patient becomes fretful, irritable, and enfeebled. leep is restless, interrupted by dreams, and characterized in many ases by unconscious grinding of the teeth. The bowels become irreg- lar or constipated, and finally some one or more of the cranial nerves xhibit evidences of weakness or paralysis. In many cases there is tosis or strabismus. These ocular symptoms, or the appearance of cho- oidal tubercles, are often the first decisive evidences of the disease. Now follow the special symptoms—headache, dizziness, stiffness of the eck, retraction of the head, sinking of the abdominal wall, obstinate onstipation, fever of an irregular and hectic type, often accompanied y a transient flush upon one or both cheeks, vomiting, contracted upils, intolerance to light, and, in many cases, a sharp and pitiful utcry that has been termed the *hydrocephalic cry*. The pulse is vari- ble, and rapidly rises as the disease advances until it can be scarcely unted. The respiratory movement is irregular, frequent, and sigh- g; and, toward the close of the disease, it exhibits the Cheyne-Stokes rm of respiration. (Fig. 81.) Sometimes there is no elevation of tem- rature, but in other cases it fluctuates considerably, or does not rise til the close of the disease. In certain instances the temperature is bnormal. As the disease progresses, the pupils become dilated, irium is merged in sopor, and the patient becomes comatose. Death ually occurs during the second week of the disease; sometimes, how- er, the case lingers for a number of weeks. Great emaciation and haustion are developed, and the patient dies in a state of complete nition and marasmus.

Sometimes the acute symptoms of the disease are ushered in by convul- ns which may or may not be repeated during the subsequent stages the malady. Sometimes conjugated deviation of the eyeballs, or

in an originally simple inflammation of the pleura may become sub
quently infected by a tubercular invasion, and that in this way
phenomena of tubercular pleurisy may be originated.

PATHOLOGICAL ANATOMY. The deposit generally occurs in the fo
of miliary tubercles, though sometimes larger masses exist. The ex
dation that accompanies the tubercular process is usually of a ser
character. It is sometimes tinged with blood, and occasionally becon
purulent.

SYMPTOMS. The mere presence of miliary tubercles in the pleu
membrane occasions no marked or characteristic symptoms. Wh
inflammation and exudation exist, the ordinary symptoms of pleuri
inflammation and exudation are present.

DIAGNOSIS. There are no characteristic symptoms by which
differential diagnosis can be established between tubercular and n
tubercular forms of pleurisy. The existence of pleurisy in a tubercu
patient affords strong presumptive evidence in favor of tuberculosis
the underlying cause of the disease. The existence of double pleur
is strongly suggestive of tuberculosis; so also is the occurrence o
hemorrhagic effusion when the other causes of hemorrhage into
pleural cavity (cancer, scurvy, and Bright's disease) can be exclud
Tubercular bacilli seldom exist in the exudation, since they can
liberated only by ulceration of the infiltrated tissue.

PROGNOSIS AND TREATMENT. The *prognosis* is exceedingly unfa
able. The *treatment* of the disease should be conducted in accorda
with the rules that are laid down for the management of ordinary ca
of pleurisy. Puncture of the thorax seldom affords any favorable resu
since the cause of the disease remains after evacuation of the pleu
cavity. The operation should not be performed unless rende
necessary for the relief of the heart or other important organs.

Tubercular Pericarditis—Pericarditis Tuberculosa.

ETIOLOGY. Primary tuberculosis of the pericardium is a very
event. When a tubercular deposit invades the pericardium, it is usu
a secondary consequence of tuberculosis in other organs of the b
Sometimes a previous non-tubercular pericardial effusion may bec
infected and invaded by the tubercular process.

PATHOLOGICAL ANATOMY. When pericardial tuberculosis occu
connection with general miliary tuberculosis, the deposit appear
the form of minute gray granulations, chiefly upon the epicardium
in the neighborhood of the large vessels. When the deposit is
abundant, the miliary tubercles frequently coalesce and form cons
able masses which become caseous, and sometimes undergo softe
and ulceration. The exudation into the pericardial cavity is usu
serous, but it may become hemorrhagic or even purulent. W
ulceration occurs, copious hemorrhage sometimes follows, and dea
thus occasionally produced.

SYMPTOMS AND DIAGNOSIS. It is impossible before death t
certain regarding the existence of a tubercular pericarditis, even th
all the symptoms of pericarditis are presented in the person of a t

cular patient. So far as the physical signs and symptoms are concerned, the two forms of pericarditis cannot be distinguished from one another until death gives an opportunity for examination of the pericardial membrane.

PROGNOSIS AND TREATMENT. The *prognosis* is exceedingly unfavorable. For the general rules of *treatment* see page 172.

Tubercular Peritonitis—Peritonitis Tuberculosa.

ETIOLOGY. *Primary tuberculosis* of the peritoneum very rarely occurs. *Local peritonitis* is frequently excited behind a tubercular ulcer of the intestines or about the periphery of the tubercular lymph glands. In many cases tubercular peritonitis exists as a local manifestation of general miliary tuberculosis.

PATHOLOGICAL ANATOMY. The peritoneum is usually studded with minute miliary tubercles, especially in the portion that forms the omentum. The folds of the intestines are usually adherent to one another. Adjacent organs, like the liver, the stomach, and the spleen, become connected by adhesive bands, and the entire cavity of the abdomen appears as if filled with a coagulable exudation that has penetrated every interstice and vacant space between the abdominal viscera. Sometimes there is considerable serous effusion, which may be tinged with blood or mixed with pus. In certain cases the effusion resembles the transudation of ascites. When the disease runs a chronic course the adhesions contract, and thus produce considerable displacement and constriction of the abdominal viscera

SYMPTOMS AND DIAGNOSIS. The existence of tubercular peritonitis may be inferred when the symptoms of local or general peritonitis occur in a tubercular patient, or when the symptoms of general tuberculosis are exhibited. The sufferer complains of pain and distention in the abdominal region, and the symptoms of universal disorder of health and of progressive debility are rapidly developed. The functions of the stomach and of the intestinal canal are extensively deranged, producing indigestion, constipation, or diarrhœa. Febrile symptoms manifest great variety, sometimes exhibiting the characteristics of persistent hectic fever; but in other cases the insidious advance of the disease is unattended by feverish disturbance. When there is considerable effusion into the peritoneal cavity, the symptoms of serous peritonitis are prominent, or the appearances of cirrhosis and ascites are closely counterfeited; but when the inflammation is of an adhesive character, producing contraction and induration of the infiltrated membranes, the abdominal cavity appears to be occupied by numerous irregular, indurated masses which consist of thickened intestinal convolutions or portions of the contracted omentum.

PROGNOSIS AND TREATMENT. The prognosis is very unfavorable, though recovery has been occasionally witnessed. The *treatment* must depend largely upon the character of the symptoms. Simple medical therapeutics rarely accomplish any conspicuous result, but it is claimed that the disease may be cured in about one-quarter of the cases by laying open the abdominal cavity, and thoroughly cleansing its contents by irrigation and drainage.

CHAPTER XII.

GLANDERS—FARCY. MALLEUS HUMIDUS.

ETIOLOGY. Glanders is an acute infective disease peculiar to the horse, ass, and mule, but communicable to the goat, sheep, rabbit, guinea-pig, and human beings. Dogs rarely contract the disease, and its inoculation upon them produces only local lesions. The course of the disease in the lower animals is not uniformly the same. Certain lesions are more conspicuous in one animal than in another. The severity of the disease varies exceedingly, but every part of the body is liable to its invasion. Upon the skin it produces numerous tumors of variable magnitude—the so-called *farcy buds* or tumors; in the connective tissues its ravages are characterized by multiple abscesses and by an inflammation of the lymphatic vessels which may extend to the lymphatic glands. In the respiratory passages the mucous membranes of the nose, pharynx, and trachea ulcerate and are destroyed. Pus may collect in the sinuses of the head. Nodular deposits, lobular pneumonia, and abscesses may occur in the lungs, liver, and spleen; the testicles and the epididymis also may be inflamed and occupied by purulent accumulations; the cavities of the joints may, in like manner, fill with pus.

From animals thus diseased the virulent contagion may be conveyed in the muco-purulent matter that is discharged from the nasal passages, or in the pus that escapes from various ulcers and abscesses that exist in different parts of the body. This virus may be communicated directly from the diseased animal to man, or it may be conveyed by articles upon which it has been discharged. It may thus cling to clothing, harness, bridles, and utensils that have been employed in the neighborhood of the diseased animal. In some cases, however, it is impossible to trace the source of infection, so that it was formerly conjectured that the disease might sometimes arise spontaneously. In the majority of instances it occurs among those who have been occupied in stables and among horses. The active agent of the contagion is a bacillus, almost as minute as the tubercle bacillus, which is colored by an aqueous solution of methylene-blue. Unlike the tubercle bacillus, it is not colored by Ehrlich's method, and it is bleached by nitric acid.

The virus usually enters the human body through a scratch or other solution of continuity in the skin. It is said to have been communicated through the alimentary canal by eating the flesh of glandered horses, but this is very doubtful. It is also possible that infection may take place through the respiratory passages by inhaling virulent particles with the air; but it is probable that in such cases the patient is really inoculated through some insignificant lesion in the nasal or pharyngeal mucous membrane. Babes has succeeded in conferring the

disease upon guinea-pigs by rubbing the skin of the animal with a virulent culture of the bacillus mixed with lanolin.

SYMPTOMS. The period of *incubation* generally does not exceed three to five days, though it is sometimes prolonged for a month, or even for a longer period of time. The mode of development is exceedingly variable, and the *duration* of the disease is equally variable. The acute form may lead to death in the course of a few days, while the chronic variety may persist for several years. When the disease manifests itself principally in the air passages of the body, it is called *glanders;* when the principal seat of morbid action is in the lymphatic system, producing inflammation and multiple abscesses accompanied by a cutaneous eruption, the disease is called *farcy.* Four principal varieties result from this classification:

1. *Acute Farcy.* When the contagion has been introduced through a wound or puncture, the symptoms resemble those that follow a dissecting wound. There is pain and swelling along the lymphatic vessels that communicate with the point of inoculation. The lymphatic vessels and glands become inflamed, the affected limb swells as if it were the seat of phlegmonous erysipelas. Subcutaneous abscesses form in the connective tissue; the general symptoms of purulent infection are manifested; there is headache, nausea, vomiting, pain in the back and limbs, and an irregular fever. The original seat of inoculation may heal during the course of the general symptoms, or it may become ulcerated. The ulcer is liable to assume the characteristics of phagedæna.

In many cases where the fact of inoculation has escaped observation, the disease commences with general symptoms like those that characterize the other infective fevers, and it is only after six or seven days that the development of multiple abscesses in the subcutaneous tissue throws light upon the nature of the disease. These abscesses may form very rapidly without much disturbance of the adjacent tissues, or they may be characterized by great disturbance and by extension of the inflammatory process to the lymphatic vessels and glands.

After two or three weeks the characteristic eruption appears upon the skin. It is of the pustular form, and is accompanied by copious perspiration, and sometimes by the appearance of hemorrhagic patches upon the surface of the body. The eruption is attended with great prostration, and is followed in the course of a few days by delirium, stupor, muscular spasms, profuse perspiration, involuntary discharge of feces, and death.

2. *Chronic Farcy.* This variety of the disease may be produced by inoculation or by general infection. The symptoms are less severe than in the acute variety, and are prolonged during a much greater period. After a month or six weeks, during which the patient suffers with inflammation of the lymphatics, with pains in the joints, and with vague general symptoms, abscesses begin to form. They are of considerable size, and follow one another by successive development. They generally occur upon the limbs, near the joints, or in the muscles, where some contusion or other local injury has produced a predisposition to purulent inflammation. They may be large and diffuse, or they may

be indolent and circumscribed. They may ulcerate and evacuate their contents speedily, or they may remain unopened for months together. Their contents consist of blood and sanious pus.

Abscesses that have evacuated themselves, or have been opened by the knife, are extremely liable to degenerate into chronic ulcers or fistulous openings that persist for a great length of time. The joints are painful, but do not often become the seat of purulent inflammation. The skin is rough and dry, but does not exhibit any eruption. The general health is disturbed, the patient falls into a condition of cachexia, which may terminate either in acute glanders, or may occasionally recover after a duration of many months or years.

3. *Acute Glanders.* This variety of the disease may exist as the terminal stage of the chronic forms of the disease, or it may occur as an independent result of inoculation. The first stage of the disease is characterized by the local phenomena that follow inoculation, or by the general symptoms of infection. These phenomena are followed by the development of abscesses, sometimes accompanied by the appearance of erysipelas upon the face, and occasionally upon the limbs. About the same time, or more frequently after the appearance of erysipelas, toward the end of the first week of the disease, an eruption of pustules, like those of ecthyma or of smallpox, appear all over the body and limbs. Their number may vary from a single pustule to many hundreds. They are generally discrete, but sometimes become actually confluent. They are sometimes very small, and occasionally constitute bullæ nearly an inch in diameter filled with sanious pus. The tendency to gangrene manifests itself in the parts that have been invaded by erysipelas, and in the ulcerated cavities of the pustules and bullæ that constitute the eruption. During the evolution of these cutaneous disorders, the characteristic symptoms of glanders are developed in the nasal passages. The mucous membrane swells, a sensation of obstruction is experienced in the posterior nares, and a muco-purulent discharge streaked with blood excoriates the nostrils and upper lip, or finds its way backward into the pharynx. The nose swells and becomes painful, the conjunctivæ become inflamed, ulceration invades the nasal cavities, the pharynx, tonsils, and the larynx. The cavity of the mouth may also become involved in the same manner. There is cough and an expectoration of fetid matter. The lungs may be invaded by lobular pneumonia, or by an hypostatic congestion of the inferior portions. Vomiting and diarrhœa, with offensive stools, are frequent, and the spleen is sometimes enlarged. The temperature is rarely excessive, but it may rise to 106° or 107° F. The fever is irregular and remittent, as in other fevers attended by suppuration. The pulse is weak, rapid, and irregular. A trace of albumin may be discovered in the urine. The nervous system gives evidence of great prostration and disturbance. Delirium frequently exists, or the patient exhibits a dull and vacant appearance, as in typhoid fever. Convulsions sometimes occur, and in the majority of cases death, preceded by stupor and coma, terminates the disease in the course of a few days. If preceded by the chronic forms of glanders, or by farcy occurring as an independent affection, it generally continues for three or four weeks.

4. *Chronic Glanders.* The essential feature of this variety of glanders is ulceration in the nasal passages and respiratory tract. It usually occurs as the sequel of chronic farcy. In addition to the symptoms that characterize the introduction of the other varieties of the disease, there is cough, pain in the throat, and a most distressing obstruction of the nose. There is not the swelling and appearance of active inflammation that are present in acute glanders, but there is a constant obstruction, involving most frequently the left nasal passage. It becomes necessary to clear the nose more frequently than usual. The matter thus discharged is muco-purulent, thick, and streaked with blood, giving evidence of ulceration. The ulcers are seldom visible, on account of their location in the upper and lateral portions of the nasal cavities. Similar ulcerations sometimes exist in the mouth and pharynx, the voice becomes altered in character, it is difficult to swallow, and the patient is continually expectorating thick and bloody matter. There is a harassing cough, accompanied by abundant expectoration of blood-streaked mucus. Occasionally the bronchial tubes or the lungs may become inflamed. The sub-maxillary glands are seldom enlarged, and there is no eruption upon the skin. Abscesses, however, appear upon the surface of the body, as in farcy. Articular and muscular pains are more pronounced in chronic glanders than in other varieties of the disease. The general symptoms resemble those observed in chronic farcy; fever, gradual exhaustion, anæmia, nausea, diarrhœa, and manifold nervous disturbances mark the slow progress of the disease toward its fatal termination. Its duration may occupy many months, and death may sometimes be preceded by the symptoms of acute glanders.

Diagnosis. The disease is frequently obscure and difficult of recognition. It should be suspected when patients who have had the care of horses present any of the symptoms that have been detailed. Sometimes, however, the autopsy alone can clear up the diagnosis. It is particularly obscure when the disease has been produced by general infection without prior local manifestations. It may frequently be mistaken for acute articular rheumatism or for typhoid fever. Careful observation of the temperature, however, suffices to differentiate *typhoid fever.* The diarrhœa of fever usually commences early, while that of glanders does not appear until the last stage of the disease.

Articular rheumatism presents more difficulties, but the course of the disease and the occurrence of abscesses, ulcers, and naso-pharyngeal lesions should suffice to distinguish glanders.

Facial erysipelas may resemble that which is observed in the last stages of glanders, but the previous history and the cutaneous eruptions mark a decided difference between the two diseases.

In like manner the concomitant symptoms, the irregularity of the form and appearance of the pustules and bullæ, should distinguish the eruption of glanders from that of *smallpox.*

Syphilis presents many points of resemblance with glanders, but the characteristic pains of syphilis have their seat in the bones, and not in the muscles or in the joints, and they are especially aggravated at night. Gummy tumors develop slowly, and are generally observed on the tibiæ, sternum, clavicles, and cranium. They do not contain

the sanious pus that fills the abscesses of glanders. When syphilis attacks the nose it rapidly destroys the bones, producing collapse and deformity of the organ, but the nasal lesions of glanders involve the bony structures in a very slight degree. Certain superficial ulcerations of the naso-pharyngeal mucous membrane do sometimes, however, closely resemble the simple ulcerations of glanders. The ulcerations that occur in the mouth, pharynx, and larnyx or trachea, in both diseases resemble each other so closely that the previous history of the patient and other concomitant symptoms must be taken into consideration in the determination of the diagnosis.

Tubercular ulcerations present a similar character, but may be differentiated by examination of the bacilli that characterize the disease.

PROGNOSIS. Few patients who have been attacked with glanders escape death. So long as the disease is limited to the lymphatic structures there may be hope of recovery, but the appearance of general symptoms and the manifestations of the acute variety of the disease are almost invariably followed by death.

PATHOLOGICAL ANATOMY. Besides the lesions already described the autopsy may exhibit a certain amount of suppurative inflammation of the bones, multiple abscesses in the muscles, diffuse suppuration in the articulations and veins, deposits of pus in the lungs, or, in certain cases, the characteristic appearances of pneumonia, swelling of the spleen, fatty degeneration of the liver, and catarrhal inflammation of the kidneys. The testicles and the parotid gland are sometimes also the seat of suppuration. In fact, the lesions thus discovered are very similar to the phenomena that are presented after death from purulent inflammation and pyæmia, being dependent, no doubt, upon the coincident activity of the micrococci that produce such inflammations, together with the specific bacilli of glanders.

TREATMENT. The point of inoculation should be immediately destroyed by cauterization with the most active agents, such as the actual cautery, acid nitrate of mercury, or fuming nitric acid. If treatment has been deferred until the lymphatic vessels show signs of inflammation, the affected part must be treated as if it were the seat of a dissecting wound. Local bleeding, poultices, and inunction with mercurial ointment, with active tonic medication and alcoholic stimulants, comprise the most efficient agents that can be recommended. When the disease is fully developed the local lesions must be disinfected and treated in accordance with the general principles of surgery. The nasal passages and the pharynx should be injected three or four times a day with non-poisonous disinfectant solutions, such as boric acid or permanganate of potassium; carbolic acid in solution may be employed as far as possible without exposing the patient to the risk of swallowing any considerable quantity of the drug. During the acute stage of the disease, alcoholic stimulants and opiates must be employed in quantity sufficient to support the failing strength, and to quiet the agitation of the nervous system. Tonic remedies are useless except in the chronic varieties of the disease. Preparations of iodine and sulphur have been recommended; inunction with mercurial ointment has been thought beneficial. The tinctures of iron, Fowler's solution, nux vomica, an

strychnine have all been tried with occasional good results, though too often of a merely temporary character. Iodide of potassium, sulphur, and the strong sulphur waters are probably the most useful constitutional remedies that can be employed.

CHAPTER XIII.

SYPHILIS.

For complete information regarding the nature, symptoms, mode of infection, and course of syphilis, the student is referred to the special monographs and surgical text-books that deal with this subject. For the purpose of the present volume it will be sufficient to consider those tertiary forms of the disease that manifest themselves principally in the internal organs of the body.

Syphilis is one of the most virulent and infective of the communicable diseases. Introduced through any solution of continuity or even by transudation through the layers of the skin, the invasion of the contagion is characterized by a period of incubation that continues about twenty-five days, more or less. The initial ulcer then appears, which, by its hardened base, indicates the fact of general infection. The neighboring lymphatic glands rapidly participate in the process of inflammatory induration and enlargement, and in the course of a few weeks the secondary period of the disease is fully established. This is characterized by the appearance of various eruptions upon the cutaneous and mucous surfaces of the body. These eruptions are either erythematous, papulous, squamous, vesicular, or pustular. The most characteristic lesion during this period is the *condyloma*, a modification of the papular form, which is usually developed around the orifices of the body and upon the mucous membranes. The condylomatous patches originate in papular elevations constituted by infiltration of the skin with round cells and by proliferation of its papillæ. By the confluence of neighboring condylomata, broad, flattened, and slightly elevated prominences are produced, that are covered with moistened and softened epidermal cells. Where opposite folds of the skin are placed in contact, the growth of a condyloma upon one surface is soon followed by the appearance of a corresponding lesion upon the other, through direct local infection. Wherever moisture finds access to a condylomatous patch the superficial epidermis becomes macerated, and a copious exudation oozes from the unprotected vessels of the papular mass. For this reason the condyloma is one of the most dangerously infective lesions in syphilis.

Besides the forms of eruption above mentioned, *ulceration* about the *nails* and between the *toes* is frequently observed. The nails themselves may become diseased, and in like manner the *hair* is loosened and falls off. Sometimes the *skin* becomes extensively pigmented.

In other cases the cutaneous surface is deprived of its normal pigment, and patches of *leucoderma* make their appearance. Occasionally the integument becomes inordinately thickened.

The *fasciæ*, *tendons*, *muscles*, and *joints* often become painful and sensitive to pressure. Sometimes the *periosteum* of the bones undergoes inflammation. *Iritis* and various forms of *choroiditis* may invade the tissues of the eye. Severe *neuralgic pains* are not uncommon, and in many cases *anæsthesia* exists in the extremities, especially in the hand or forearm. The *bones* also become sensitive, either as a consequence of periostitis or by reason of actual inflammatory changes involving the osseous tissue itself.

The secretions from condylomata and from all other secondary lesions of syphilis are highly infective. The contagion exists also in the blood, in the seminal fluid, and in the ovum; but the other physiological secretions do not contain the poison unless contaminated by mixture with pathological products. The nature of the contagion is unknown, though it is probably of bacterial origin.

The *tertiary symptoms of syphilis* are frequently prevented from development by a judicious and energetic course of treatment during the secondary period of the disease; but no person who has been once infected can be regarded as positively secure against tertiary manifestations, since they often appear after many years of apparently perfect health and freedom from every syphilitic symptom. Sometimes they are developed, even without the previous manifestation of secondary phenomena, or after the occurrence of secondary symptoms of a character so insignificant that they had escaped the observation or memory of the patient. The evolution of tertiary phenomena is very often dependent upon the occurrence of injuries or other causes that deteriorate the health and depress the natural vigor of the organism. Those organs or portions of the body which have been overworked or damaged by injury or by other diseases are especially liable to the invasion of tertiary syphilis.

The characteristic lesion of tertiary syphilis is the *gumma* or *gumma tumor*, which may develop in any of the different tissues and organs of the body. It consists essentially of a chronic inflammatory process characterized by an abundant exudation of small round cells that separate and encroach upon the normal elements of the affected part, occasioning partial obliteration of its bloodvessels and interference with the lymphatic circulation. In the tumors that are thus produced there is a tendency to final necrosis of the structure and ulceration of the adjacent tissue. In this way gummy tumors that are situated in the skin and subcutaneous connective tissue become the bases of ulcerative processes that are manifested upon the surface in the form of *sores* that are covered with conical, laminated scabs, like limpet-shells piled one upon another (rupia). Frequently the ulcers that have been thus formed extend themselves along one margin, while the healing process goes on upon the other. In this way *serpiginous sores* of a horseshoe form are developed. The process of cicatrization is always accompanied by considerable loss of cutaneous substance, so that a conspicuous scar is formed. For a long time this remains deeply pigmented, or, after

considerable period, may exhibit a white centre surrounded by a border of brown pigment. Such ulcers frequently produce deformity of the lips, nostrils, ears, eyelids, and other conspicuously retractile portions of the skin.

Gummy tumors do not always ulcerate, but frequently undergo gradual absorption and final disappearance. The infiltrated tissue, however, is in great measure destroyed during this process, so that the site of the cutaneous tumor may be easily recognized by a depression in the skin and subjacent substance.

The *muscles*, together with their sheaths, tendons, and bursæ, are sometimes invaded by gummatous growths. These sometimes involve the connective tissue in the form of diffuse infiltration, sometimes in the form of a circumscribed tumor. The contractile substance of the muscle undergoes degeneration and absorption as a consequence of the pressure that is thus maintained. Sometimes suppuration and evacuation of the mass takes place, but frequently it is gradually absorbed, like the corresponding cutaneous tumors, and the muscles become disabled by the consequent loss of substance and induration of the adjacent tissues. In this way contracture and deformity may be produced.

The *joints* are not unfrequently damaged by the formation of gummy tumors in the articular extremities of the bones or in the subserous substance of the articulation itself. Painful swelling, like that of acute rheumatism, may be thus produced, and may be followed by suppuration, by ankylosis, and by general destruction of the articular mechanism. In milder forms of the disease simple chronic distention of the joint with a serous transudate may be the principal symptom of the disease.

The *bones* are frequently invaded by syphilitic inflammation at an early period of the disease, and during its tertiary stage gummy tumors often develop either in the periosteum or in the bone-marrow. In either case their growth results in destruction of the osseous substance, producing a fragility of the bones that sometimes renders them especially liable to fracture. Those portions of the skeleton that lie immediately beneath the skin appear to be the favorite seats of gummatous infiltration. It is, therefore, not uncommon to discover swelling and tenderness upon the bones of the cranium, upon the collar-bone, the ribs, the shoulder-blades, the sternum, and the prominent surfaces of the ulna, radius, tibia, and fibula. In many cases these superficial gummata ulcerate and penetrate the overlying skin, so that the necrotic bone is readily visible through the openings that are thus produced. Extensive ulceration of the cranial bones is sometimes witnessed, exhibiting the genuine "raw head and bloody bones" of vulgar narrative. Sometimes extensive necrosis is followed by exfoliation and discharge of considerable portions of the cranial vault. The absorption of a periosteal gumma is frequently followed by the formation of a palpable depression in the bony surface, and the overlying skin becomes firmly adherent over its entire extent. Sometimes the infiltrated bone undergoes calcareous degeneration that results in consolidation and eburnation of the previously inflamed and disorganized structure.

The processes that accompany syphilis of the bones are extremely

tedious and painful. Though not particularly dangerous to life, they frequently result in conspicuous deformity and serious crippling of the patient. When attended by prolonged suppuration there is always danger of intercurrent amyloid degeneration in other tissues and organs. It is not always easy to distinguish between tubercular and syphilitic lesions of the bones, unless it be possible to discover the presence of tubercle bacilli or to produce a characteristic febrile reaction by the hypodermic injection of tuberculin.

Syphilis of the Nose—Syphilis Nasi.

Symptoms and Diagnosis. Tertiary lesions involving the nose are of a gummatous nature, and may originate either in the external cutaneous investment, or in the mucous lining of the organ, or may take their point of departure from the substance of the nasal cartilages and bones.

Cutaneous gummata may be easily mistaken for lupus or for cancerous diseases of the nose. When the *mucous membranes* are invaded, severe ulceration, obstruction of the nasal passages, and a copious, offensive discharge are the principal symptoms. It is not often that the *nasal cartilages* are primarily invaded, but when they become ulcerated the septum of the nose may be perforated or wholly destroyed, so that the nostrils are transformed into a single, irregular chasm that opens into the depressed, retracted, and deformed stump of a snout, giving a hideous aspect to the formerly regular and agreeable features of the countenance.

Gummatous inflammation of the *nasal bones* may involve any portion of their structure, resulting in more or less extensive loss of substance and consequent deformity of the nose. The ulcerative process may extend upward into the cavity of the cranium, producing fatal meningitis; but it more frequently involves the bones of the hard palate, and produces a characteristic perforation of the roof of the mouth. In this way great interference with the functions of deglutition and of speech may be established. Liquids can be no longer excluded from the nasal cavity during the act of swallowing, and the voice assumes a peculiarly indistinct and nasal character. The ulcerative process is usually accompanied by great pain, considerable swelling of the soft parts, a horribly offensive discharge (ozæna syphilitica), and often by the exfoliation of considerable fragments of the diseased bones.

Treatment. The general treatment consists in the administration of iodide of potassium (potass. iodid. ℥ss, aquæ ℥vj. Sig. A teaspoonful in half a glass of water after each meal), and in the use of mercurial inunctions. Mercurial ointment should be rubbed into the skin after a warm bath at bedtime. The skin should be thoroughly cleansed with soap, and the ointment may be rubbed, at first, upon the inner surface of one leg; the next day upon the opposite leg; then upon the inner surface of one of the thighs; the next day upon the other; then upon the inner surface of one of the upper arms; then upon the other; and lastly upon either side of the thorax; after which the round may be commenced again upon one of the lower extremities. In this way irri

tation of the cuticle through excessive friction may be avoided. Hairy portions of the body will not tolerate any considerable amount of friction, since the roots of the hairs are liable to inflammation when thus severely treated. The mouth should be carefully guarded during the period of inunction by attention to the condition of the teeth, and by frequent gargling with a five per cent. solution of chlorate of potassium. Smoking must be interdicted, since it favors the occurrence of mercurial stomatitis. The diet must be abundant, but of an unexciting character. Alcoholic stimulants, spices, and rich sauces must be forbidden. The clothing should be warm, and moderate exercise in the open air may be encouraged, though all exposure to wet and cold must be avoided.

In addition to the general treatment above indicated, local applications are indispensable. If the external surfaces are ulcerated, great benefit will be derived from the application of adhesive plasters thickly spread with mercurial ointment. When the nasal passages are obstructed by the products of inflammation, nasal douches containing two per cent. of carbolic acid, or corrosive sublimate (1 : 1000). Diluted Listerine, and a solution of boric acid, or of permanganate of potassium, may be also employed. Having thus thoroughly cleansed the diseased surfaces, they should be brushed with iodized glycerin (potass. iodid. 10 parts iodini cryst. 1 part, glycerin 100 parts), or they may be thoroughly powdered with iodoform, or with calomel and alum in equal parts. The ultimate deformity that sometimes follows extensive necrosis requires surgical measures for its removal.

Laryngeal Syphilis—Syphilis Laryngis.

Symptoms and Pathological Anatomy. Laryngeal disease is frequently one of the early consequences of the secondary form of syphilis, but it also may exist as a tertiary lesion many years after the original infection. It may occur among children as a symptom of hereditary syphilis, but it then manifests no special difference from the laryngeal syphilis of adults. By the aid of the laryngoscope it is possible to recognize slight changes in the laryngeal mucous membrane, even before any noteworthy symptoms are furnished from other sources. Among the earlier forms of laryngeal syphilis are catarrhal inflammation and condylomata of the mucous membrane; among the later forms of the disease, gummatous swellings are the most conspicuous. These lesions constitute the *primary* forms of syphilis in the larynx. *Secondary* ulceration of the infiltrated structures not unfrequently occurs, and produces extensive destruction of the laryngeal membranes, cartilages, and vocal cords. Deformity and stenosis of the laryngeal passages are the usual consequences of such ulceration. Sometimes œdema of the glottis is developed, and suffocation may be produced by progressive contraction of the laryngeal orifice.

Syphilitic catarrh of the *larynx* presents no visible appearances that differ from those which accompany ordinary inflammation of the laryngeal mucous membrane. The disease is, however, of a more persistent character; and when the vocal cords are involved, a peculiar hoarseness

that is suggestive of its origin forms a very noticeable symptom. In many cases, however, only the ordinary disagreeable sensations of tickling, burning, and inclination to cough accompany the laryngeal disorder.

Condylomatous patches, similar to those which develop in the pharynx, frequently occur upon the vocal cords, upon the arytenoid cartilages, and posterior wall of the larynx. If left without treatment, these patches are very liable to ulceration.

Among the tertiary symptoms of syphilis are *laryngeal gummata*. Their favorite seat is upon the epiglottis, though they are also observed upon the vocal cords and elsewhere. They exist either in the form of circumscribed tumors of variable size, or as a considerable infiltration of a diffuse and irregular character. They may produce laryngeal stenosis, either during the stage of infiltration, or as a consequence of cicatricial contraction. During the ulcerative stage serpiginous ulcerations gradually develop, and slowly eat their way into the tissues of the organ.

The principal danger in laryngeal syphilis consists in the tendency to œdema during the period of ulceration, and to suffocation as a consequence of progressive stenosis during the period of cicatrization and contraction. Dangerous hemorrhage occasionally occurs during the period of ulceration. Suffocation is rarely produced by the entrance of food into the larynx after destruction of the epiglottis, since the laryngeal orifice is sufficiently occluded, during the act of deglutition, by the false vocal cords and by the retracted base of the tongue.

Diagnosis. The diagnosis of laryngeal syphilis is sometimes rendered difficult by the absence of other syphilitic lesions, and by the lack of veracity or knowledge on the part of the patient. So great is the similarity between the laryngeal lesions of syphilis and *tuberculosis* that, in such cases, the diagnosis of syphilis must rest upon the exclusion of the symptoms of tuberculosis in the lungs, and upon the absence of tubercle bacilli from the laryngeal exudations. The laryngeal lesions of *leprosy* are associated with pronounced symptoms of the disease upon the external surface of the body. *Cancerous disease of the larynx* can be with difficulty distinguished from syphilis. Its course is usually more painful and rapid than that of syphilitic disease. When *tuberculosis* and *syphilis* are combined in the same patient, a differential diagnosis is impossible.

Prognosis. The prognosis in cases of laryngeal syphilis is always attended with gravity, especially when treatment has been neglected or postponed. Even after recovery from the active process of disease there is great danger of progressive stenosis that may necessitate tracheotomy and a permanent use of a tracheal canula.

Treatment. The treatment of laryngeal syphilis must be both general and local. The course of general treatment has been already described. Local treatment in the catarrhal forms of the disease consists in the inhalation of a pulverized solution of corrosive sublimate (0.01 : 100). Laryngeal condylomata should be treated with daily insufflations of calomel and powdered gum-arabic (2 : 3). Ulcerated gummata should be painted every day with iodized glycerin, or

patient may be made to inhale the pulverized aqueous solution of iodide of potassium (1 : 200).

Tracheal and Bronchial Syphilis—Syphilis Tracheæ et Bronchorum.

The *trachea* and *bronchi* are occasionally the seat of syphilitic lesions identical with those which have been already described in the laryngeal tissues. Catarrhal inflammation, condylomata, and gummatous ulceration may exist in circumscribed portions of the tracheal or bronchial passages; but sometimes the entire extent of the respiratory tract is occupied by the disease. Great irritation, cough, and expectoration usually accompany the morbid process. Sometimes, however, the course of the disease is exceedingly insidious, and conspicuous symptoms only appear when constriction of the air passages has been established. Sometimes the lungs are infected by the passage of morbid secretions into the alveolar passages and air cells, producing catarrhal pneumonia, abscess, or gangrene of the lungs.

The treatment of tracheal syphilis does not in any respect differ from that of the laryngeal variety of the disease.

Pulmonary Syphilis—Syphilis Pulmonum.

Pathological Anatomy. Pulmonary syphilis exists in two forms: either as a *diffuse infiltration*, or as circumscribed *gummy tumors* in the substance of the lungs.

Pulmonary infiltration of a syphilitic origin usually occurs in the middle lobe of the lungs. The right lung appears to be affected more frequently than the left. The infiltrated portion is firm, dry, and of a yellowish-gray color, closely resembling the appearance of a pneumonic lung in the stage of gray hepatization. The exudation chiefly involves the interstitial tissue of the organ, but the epithelial cells of the alveolar spaces frequently undergo a process of infiltration and fatty degeneration. According to some observers, the principal seat of disease is located in the alveolar spaces. The endothelial layer of the lymph vessels is also invaded, and the lymph passages are more or less obstructed by cellular proliferation and by degeneration of the lymph corpuscles. When suppuration occurs, cavities are formed in the lung substance, just as they occur in the analogous conditions presented by pulmonary tuberculosis. The healing process is also followed by corresponding changes in the adjacent connective tissue, and by cicatricial contraction.

Pulmonary gummata differ chiefly from the above-described form of infiltration in the fact that they present a clearly defined and circumscribed mass. Such tumors may also undergo softening and suppuration, resulting in the formation of a cavity, and in favorable cases cicatrization and recovery may occur.

Brown induration of the lungs, similar to that which has been observed in connection with cardiac disease, sometimes occurs as a consequence of syphilis.

The *pleura* is sometimes invaded when syphilitic infiltrations or gummata involve the superficial portions of the lung. Occasionally the pleura becomes greatly thickened and contracted as the result of an independent syphilitic process.

SYMPTOMS AND DIAGNOSIS. It sometimes happens that pulmonary syphilis manifests few and insignificant symptoms, so that the disease is only accidentally discovered. In the majority of cases the symptoms correspond with those of pulmonary tuberculosis. Tubercle bacilli are, however, absent from the sputa.

PROGNOSIS AND TREATMENT. When the cause and nature of the diseased tumors are early recognized, a tolerably favorable prognosis is rendered possible. The treatment must be conducted in accordance with the general rules already laid down on page 200.

Syphilis of the Alimentary Canal—Syphilis Tractus Intestinalis.

SYMPTOMS. During the secondary stage of syphilis, *erythematous* and *condylomatous eruptions* frequently exist within the cavity of the mouth, which may thus become painfully ulcerated. Besides these manifestations upon the tongue, in the tertiary stage of the disease, *gummy tumors* are frequently developed in that organ. These closely resemble the infiltrations that are produced by cancer and by tuberculosis, but they are less frequently accompanied by induration of the adjacent lymph glands. They are usually solitary, and yield not unfrequently to energetic anti-syphilitic treatment. It was formerly supposed that certain fissured appearances of the tongue, and certain white, scaly patches upon its upper surface were caused by syphilis, but it is now well known that such lesions have no necessary connection with that disease.

Gummy tumors often develop in the roof of the mouth, in the fauces, and in the pharynx. By their ulceration the uvula may be destroyed, and adhesion may take place between the soft palate and the posterior wall of the pharynx, so as to occlude more or less completely the naso-pharyngeal passages. When such tumors originate in the periosteum, the bones of the roof of the mouth are often invaded, and perforation of the hard palate may result in the formation of a communication between the cavity of the mouth and the nasal passages above. Sometimes the ulcerative process results in fatal hemorrhage from erosion of the internal carotid or other large bloodvessels in the neighborhood of the pharynx. Sometimes the salivary glands become indurated, and if the œsophageal walls are attacked, ulceration and cicatricial stenosis of the œsophagus are produced.

Gummatous infiltration of the *gastric walls* has been known to occur, and it is probable that ulceration of the stomach may be sometimes thus produced. In the same way the *mucous membrane* of the *intestine* is occasionally invaded, producing the symptoms of intestinal ulceration, and sometimes leading to perforation and peritonitis. It is probable that the diarrhœa which is sometimes observed in syphilitic patients, and is cured by mercurial treatment, is the result of syphilitic catarrh of the intestines.

The *rectum* is often the seat of gummatous infiltration and ulceration. The symptoms resemble those of dysentery, and exploration of the passage with the finger discovers the existence of ulceration, induration, and cicatricial contraction of the parts.

TREATMENT. The general treatment of syphilis must be associated with such local applications and anodynes as are needed for the relief of pain, and for stimulation of the ulcerated surfaces.

Hepatic Syphilis—Syphilis Hepatis.

Syphilitic disease of the *liver* is usually encountered during the tertiary stage, or as one of the consequences of hereditary syphilis.

PATHOLOGICAL ANATOMY. *Hepatic syphilis* manifests itself in a variety of forms. It may produce syphilitic *perihepatitis*, in which the serous investment of the organ is thickened and becomes adherent to the neighboring organs; or it may occasion a *diffuse interstitial inflammation* of the *interlobular connective tissue* by which the parenchyma of the organ is destroyed. The liver may be also invaded by gummatous inflammation, which occurs in two forms: a *miliary infiltration*, and the ordinary larger *gummatous tumors*. The *miliary gummata* exist as numerous minute yellow masses scattered throughout the liver. They consist of round cells connected with the walls of the bloodvessels, biliary passages, and lymph canals. By their aggregation and coalescence ordinary *gummy tumors* may be constituted. These vary from the size of a pea to that of an orange. They are generally found in the neighborhood of the suspensory ligament, and upon the lower border of the liver. The newly formed tumors consist chiefly of round cells, and present, on incision, a reddish-brown color; but at a later period of their growth they frequently undergo caseation, and sometimes suppuration, resulting in the formation of an abscess from which the softened contents of the tumor may find their way into the neighboring bile ducts. Sometimes, however, the process of degeneration is terminated by calcification of the mass.

When gummy tumors extend to the surface of the liver and branch out extensively into its substance, their degeneration and cicatrization are followed by irregular contraction and consequent deformity of the organ, so that in advanced cases of syphilitic disease the contracted liver appears as if cloven into numerous lobulated masses.

Cirrhosis and *amyloid degeneration* of the liver may have their origin in syphilitic disease, but in other respects these forms of syphilitic degeneration do not differ from ordinary cirrhosis and amyloidosis.

SYMPTOMS AND DIAGNOSIS. Syphilis of the liver often pursues a course so insidious and so little accompanied by pain that the existence of the disease is only discovered after death. When symptoms of hepatic disorder exist, they are so varied and so like the symptoms of ordinary hepatic disease that their reference to a syphilitic source is often only a matter of inference from the fact of previous syphilitic manifestations in other organs of the body.

PROGNOSIS AND TREATMENT. The *prognosis* in cases of hepatic syphilis is ordinarily unfavorable, since recovery from the active symp-

toms of disease may still be followed by the consequences of cicatricial contraction and interference with the function of the hepatic cells, and with the outflow of bile.

The *treatment* consists chiefly in the administration of iodine and its compounds. Mercurials must be used with considerable caution. Hot baths and brine baths and saline mineral waters may also be used with advantage.

Syphilis of the Spleen—Syphilis Lienis.

The spleen is frequently invaded by syphilitic disease. In the *early stage* the organ is acutely enlarged, as it is in so many other infective diseases, and so long as it remains enlarged the patient is liable to relapses, but under proper anti-syphilitic treatment the tumor finally disappears.

During the *later stages* of *syphilis* the spleen frequently undergoes *chronic interstitial inflammation*, involving the connective tissue. The organ becomes enlarged and indurated, and its surface is frequently adherent to the neighboring organs. Similar changes are observed as a consequence of congenital syphilis.

During the *tertiary stage* of *syphilis* gummy tumors of various size are often developed in the spleen, where they undergo caseation, and if absorbed give origin to cicatricial contraction and consequent deformities of the organ.

For remedial agents the iodides are to be preferred.

Renal Syphilis—Syphilis Renum.

All forms of renal disease may be produced by syphilis, and there is nothing by which the ordinary renal diseases can be differentiated from those of syphilitic origin, unless it be the fact that there is often a greater amount of proliferation in the connective tissue when the inflammation is of a syphilitic character, and that the subsequent retraction and deformity of the kidney is considerably greater than in cases of ordinary interstitial nephritis. Occasionally gummy tumors develop in the kidneys. These may be either of miliary dimensions or of larger size, and they differ in no essential particular from the similar manifestations in other organs. They may either undergo caseation or absorption, with subsequent contraction and deformity of the organ.

Syphilis of the Sexual Organs.

The epididymis is rarely involved in syphilitic disease unless the testicle is at the same time invaded. The same thing is also true of the vas deferens, the vesiculæ seminales, and the prostate gland. In the testicle the tunica albuginea is frequently thickened. Sometimes the interstitial connective tissue of the organ is the principal seat of proliferation, and sometimes gummy tumors make their appearance in the substance of the organ. Unlike similar cancerous infiltrations, gummy tumors are not sensitive to pressure, nor are they accompanied by degeneration of the inguinal lymph glands. Tuberculosis also differs

yphilis in the fact that it commences always in the epididymis. gummy masses undergo a softening and suppuration the ordinary mena of abscess formation and evacuation are presented.

Syphilitic Disease of the Vascular Organs.

muscular substance of the heart may be invaded by gummy s or by diffuse infiltration of syphilitic origin, greatly interfering the function of the cardiac muscle. When the endocardium is ed it becomes considerably thickened, and valvular lesions may is produced.

mmy indurations sometimes invade the pericardium, and may inflammation of its surface.

philis sometimes produces arterio-sclerosis of the larger arteries, laying the foundation of future aneurismal growths. Even more tant are the effects of syphilitic endarteritis upon the smaller es of the body. Sometimes thickening and induration of the lar walls proceed so far as to produce actual occlusion of the ed vessels. Gangrene of the tissues, thus deprived of their blood y, has been observed.

Cerebral Syphilis—Syphilis Cerebri.

IOLOGY. Under the term *cerebral syphilis* are grouped all those litic diseases which involve not only the substance of the brain, s bloodvessels and membranes. In many instances the cerebral is are associated with or follow syphilitic diseases in the cranial . In this way abscesses may be produced in the brain, or com- ion of the cranial nerves may take place in the bony canals gh which they pass toward the periphery.

e brain is one of the most common seats of visceral syphilis. In ajority of cases it is during the tertiary stage of syphilis that ral lesions are produced, so that their occurrence may date many subsequent to the initial infection. This rule, however, is not ut exceptions, so that in certain cases cerebral disorders follow y after the manifestation of the secondary symptoms of syphilis. ong the predisposing causes of cerebral syphilis is the existence neurotic constitution, leading to speedy exhaustion of the brain that organ is subjected to fatigue, excitement, injury, or other of disease. Exhaustion, debauchery, concussion, or other injuries brain, inefficient treatment of syphilis in its early stages, and remature development of the tertiary stage, all seem to act as posing causes of cerebral syphilis.

hilitic disease of the brain is obviously more common among , yet children who have inherited syphilis sometimes exhibit ces of its location within the cranium.

THOLOGICAL ANATOMY. Intra-cranial syphilitic lesions usually nce in the bloodvessels and membranes of the brain. It is le that when the cerebral substance itself is invaded, the process nces either in the meninges or in the bloodvessels. In the

meninges the morbid process takes the form of gummatous growth, usually from the dura mater, and also from the subarachnoid tissue. Originating between the two layers of the dura mater, the gummy mass may develop outward, or may press inward into the brain itself. The neoplastic formations occur more frequently upon the convexity of the brain, often invading the falx cerebri, but are also found in the neighborhood of the cavernous sinus at the base of the brain. When located in this region the third and sixth nerves are frequently subjected to pressure, producing paralysis of the ocular muscles. In many instances the gummatous growths exist in the form of circumscribed tumors which may reach considerable size, though frequently they exhibit the form of minute miliary granulations upon the meninges. In other cases the morbid process consists in a diffuse infiltration without any definite limits, resembling in many respects an ordinary inflammatory exudation. In this way thickening and adhesion of the meningeal surfaces may be produced. When the process extends into the substance of the brain it may finally result in softening, suppuration, and extensive destruction of the cerebral tissues.

When the *cerebral arteries* become the seat of syphilitic disease, the external and middle coats of the vessels are invaded by gummy growths, or the inner lining of the vessels is attacked by endarteritis. These different processes are most intimately related to each other. Endarteritis may exist alone, though it is frequently excited by disease in the outer layers of the vascular wall. These changes are most conspicuous in the arteries that contribute to the formation of the circle of Willis, especially the basilar artery, the middle cerebral, and Sylvian arteries. For this reason symptoms of disease in the pons Varolii, and lesions of the third frontal convolution and island of Reil, producing *aphasia*, are frequently encountered in cases of cerebral syphilis.

The changes thus produced in the arterial walls are plainly visible to the naked eye. They consist in an irregular thickening and induration of the vascular wall, by which the lumen of the vessel may be more or less completely constricted or even totally obliterated. Thrombi frequently occupy the constricted portions, cutting off the supply of blood from those portions of the brain that lie beyond the seat of obstruction. In this way softening and paralysis of circumscribed parts of the brain may be produced. The gravity of such lesions is greater the nearer to the base of the brain they are located. Obstruction of the peripheral portions of the cerebral circulation upon the convexity of the brain admits of a greater degree of compensation through inosculation of the neighboring vessels; but upon the inferior surfaces of the organ such compensation is almost impossible.

Besides the arterio-sclerotic and endarteritic changes that have been described, *aneurism* may develop upon the cerebral arteries as a consequence of syphilis. The occurrence of similar diseases in the heart and in the large thoracic vessels, may lead to embolic or thrombotic obstruction in the brain; so that syphilis may result in injury of that organ either by its direct action, or indirectly through the medium of the circulation.

SYMPTOMS. The symptoms of cerebral syphilis may be manifested ther through disorder of the intellectual processes, or through dis- rbances of sensation and motion.

Psychical changes are not uncommon. The patient loses energy, comes forgetful, irritable, despondent, or even completely insane. The rogressive paresis of the insane often has its origin in syphilis. Some- mes a species of hypochondria termed *syphilophobia* may be observed. n this disorder the patient is continually occupied with the idea that e is a victim of syphilis, though a similar delusion is sometimes mani- sted by persons who have never become victims of the real disease. n like manner *hysteria* and *neurasthenia* sometimes have their origin n syphilis.

In certain cases paroxysms of *aphasia* are experienced. These may ontinue for a number of hours or for several days, and then terminate uite suddenly. Repeated paroxysms of this sort, that are unattended y paralysis of the extremities, are especially suggestive of cerebral yphilis. They are probably dependent upon disorders of the circula- tion in the territory of the Sylvian artery.

In certain cases overwhelming *somnolence* occurs. The patient lies for many hours or days in a state of more or less profound uncon- sciousness, which may be either quiescent or disturbed by delirious dreams. The recovery of consciousness is usually gradual, and such attacks frequently follow one another with intervals of variable dura- tion. Sometimes a condition of profound *coma* is developed, during which the eyeballs are divergent; reflex movements can no longer be excited by touching the conjunctivæ, and the tendinous reflexes are either greatly diminished or completely abolished. The pulse is fre- quently retarded, and the temperature of the body is subnormal.

In contrast with such cases is the condition of obstinate *wakefulness* that is sometimes experienced by syphilitic patients. This condition may exist without any apparent cause, and may be entirely unaccom- panied by pain or intellectual excitement.

In certain cases cerebral syphilis is accompanied by intense *headache* and paroxysms of *neuralgia*. The headache assumes all the forms that characterize ordinary headache, and it sometimes terminates in coma. It is usually exaggerated by every kind of bodily or mental excitement and fatigue. It is especially severe at night, and its intensity is often intolerable, rendering the patient almost insane. Sometimes its sponta- neous cessation is so sudden that it can be explained only by the hypothesis of circulatory disorder.

Disturbances of *sensation* exhibit a great variety of forms, which may be circumscribed within very narrow limits, or may be widely diffused over many nerve tracts. The nerves of special sense are also sometimes involved. When the visual function is thus disturbed, it often happens that nothing can be discovered with the ophthalmoscope to account for the loss of sight; but in certain cases endarteritis of the central artery of the retina, and syphilitic retinitis, can be demon- strated.

Paralytic symptoms are most frequently observed in connection with he cerebral nerves. The oculomotor nerve is the principal sufferer,

and next in order comes the abducent nerve. Rapid recovery often follows the use of iodide of potassium, but relapses frequently occur. The cause of these paralyses is usually found in the compression of the nerve trunks by gummatous growths at the base of the brain; but it is remarkable how often individual branches of the third nerve escape paralysis under such circumstances.

The facial nerve is sometimes similarly affected. In many cases the paralysis is complete, though sometimes only a weakness of the affected muscles is apparent.

Paralytic conditions often occur in the extremities. When there is complete paralysis of a hemiplegic character, the tendon reflexes are almost always exaggerated upon the paralyzed side. The extent and intensity of the paralytic symptoms are exceedingly variable, involving sometimes a single extremity, the entire half of the body, or only a limited group of muscles. In certain cases the paralytic condition is completely developed, while in others, only a paretic weakness of the affected muscles is manifested. Sometimes the symptoms appear very abruptly, while again they are very slowly developed. Their duration is characterized by similar irregular variations.

The occurrence of *apoplectiform seizures* is a not uncommon consequence of cerebral syphilis. The patient may be stricken down suddenly, with all the symptoms of an apoplectic attack which may terminate fatally, or from which he may recover gradually with more or less consequent paralysis, followed by contracture and muscular atrophy like what are observed after ordinary cerebral hemorrhage. In other cases the patient remains for a long time in a somnolent condition, from which he gradually recovers, only to be stricken down in repeated subsequent attacks. Sometimes the mental faculties are greatly disturbed, and delusions dominate the intellectual processes and actions of the individual. When the paralysis involves the right side of the body aphasic symptoms are frequently observed.

Among other motor symptoms produced by cerebral syphilis may be mentioned *epilepsy*. This is frequently manifested in the form of cortical epilepsy, but in no essential particular does it differ from the ordinary forms of the disease. Its first manifestations usually occur in middle life. So frequently is this the case that the occurrence of a first epileptic attack during middle life should awaken the suspicion of a syphilitic origin.

Chorea, *tremor*, and *dizziness* of an obstinate character sometimes have their origin in cerebral syphilis, and only yield to antisyphilitic treatment. When the floor of the fourth ventricle is invaded the phenomena of *polyuria*, *polydipsia*, and *diabetes* are sometimes observed.

Diagnosis. The recognition of cerebral syphilis is comparatively easy when the history and symptoms of preceding syphilis can be established, but in the absence of these guides great difficulty may attend the diagnosis. When dealing with married people it is important to ascertain whether the offspring of their union have exhibited symptoms of hereditary syphilis; whether they died early or whether they exhibited a predisposition to scrofula or rickets. Childless ma

iages, and the occurrence of repeated abortions, are suggestive of a syphilitic cause.

Having gained all the light possible from the above-mentioned considerations, a review of the symptoms that characterize cerebral syphilis will generally guide the observer to an accurate diagnosis. In this matter a long experience and wide observation are of the greatest value to the diagnostician, who frequently finds himself compelled to decide in favor of a syphilitic origin of disease, though he may be unable to state in exact terms all the reasons for this instinctive conclusion. In doubtful cases, especially when dealing with patients in an urban population, it is wise to assume the probability of a syphilitic cause and to prescribe accordingly.

Prognosis. In every case of cerebral syphilis the prognosis is uncertain, for the dangers that attend the disease are numerous and grave. Trifling symptoms are often rapidly followed by alarming changes and a speedy death. The nearer the lesion is situated with reference to the medulla oblongata the greater the danger of a fatal result.

Treatment. The treatment should be conducted with great energy in accordance with the rules already given for the general treatment of syphilis. Many physicians prescribe mercury and iodide of potassium together, but it is usually preferable to employ active inunctions with mercurial ointment for three or four weeks before commencing the use of iodide of potassium. Inunctions may be repeated at intervals during the whole course of the disease; and even after the disappearance of symptoms, it is often a matter of prudence to renew the treatment from time to time, as a prophylactic expedient. Iodide of potassium should be given usually in five-grain doses three times a day, though many physicians advise the administration of the drug in doses of one or even two drachms three or four times a day. The paralyzed muscles may be advantageously treated with electricity and massage, in accordance with the general principles that regulate the employment of such methods.

Syphilis of the Spinal Cord—Syphilis Medullæ Spinalis.

It is undoubtedly true that syphilis is the underlying cause in many cases of disease of the spinal cord, but it is often very difficult to assign any precise value to this or that symptom as evidence of a syphilitic origin in any particular case, since apparently identical lesions may occur both in syphilitic and in non-syphilitic patients. The results of treatment are no more significant, since many diseases of the spinal cord that are of a non-syphilitic origin appear to be as much benefited by an anti-syphilitic course of treatment as are the cases in which the connection with a syphilitic source appears to be unmistakable.

Pathological Anatomy. Syphilitic diseases of the spinal cord are sometimes produced *indirectly* by the effects of previous disease in the bones or meninges of the spinal column. Various osseous tumors, gummata, carious processes, exostoses, etc., may result in compression of the cord and destruction of its substance, followed by corresponding symptoms.

But the spinal cord itself may be *directly* influenced by syphili processes in its own special substance. With the exception of gumm tous tumors of the cord it is difficult, if not impossible, to distingu syphilitic inflammation, sclerosis, induration, and atrophy, from simi lesions of a non-syphilitic character. Thickening of the meninges a their adhesion to the cord itself are suspicious circumstances. In c tain cases the occurrence of endarteritis causes obstruction of the spi vessels, and leads to the formation of minute points of myelitis scatte throughout the substance of the cord. Such changes are often ass ated with similar processes in the brain.

It sometimes happens that severe symptoms of spinal paralysis of acute ascending course, or other formidable diseases of the cord, are ma fested without the possibility of discovering after death any appar changes in the substance of the cord by which the phenomena be explained. Such cases, in the present state of our knowledge, m be considered as examples of a purely functional disorder.

SYMPTOMS AND DIAGNOSIS. So great is the number of the sy toms and diseases that may have their origin in syphilitic affections of spinal cord that it is useless to attempt their recital in this place. far as symptoms are concerned, it is impossible to differentiate syphi spinal diseases from those of a non-syphilitic character, conseque the reader is referred to those pages of this volume which treat of symptoms and diagnosis of spinal diseases.

PROGNOSIS. The prognosis in cases of spinal syphilis is more fa able than in the corresponding diseases of a non-specific character. complete recovery is not often experienced, and relapses freque occur, especially if the treatment is suspended at too early a perio

TREATMENT. The treatment of spinal syphilis should be condu in the same way as that for cerebral syphilis. Electricity, mass and other expedients may also be employed, as in cases of a syphilitic character.

Syphilis of the Peripheral Nerves.

The peripheral nerves are not often directly affected by syph disease, but they are frequently subjected to pressure, and to mor less complete consequent *paralysis*, through the development of gumm in their neighborhood, or by reason of an encroachment upon their tr through syphilitic constriction of the bony canals through which ma them pass in their course from the brain and spinal cord to the lying portions of the body. Severe *neuralgias* sometimes occur du the early portion of the secondary stage of syphilis, apparently consequence of functional disturbances of the nerves through the tating character of the infected blood and lymph by which they nourished.

Hereditary Syphilis—Syphilis Hereditaria.

ETIOLOGY. Since syphilis is a constitutional disease, it is trans sible from parents to their children, but fortunately the line of he

tary descent is here arrested, and the children's children escape. Syphilis may be transmitted by either parent, or by both of them, if both are diseased. It is during the secondary period that such hereditary transmission chiefly occurs. The children of parents who are suffering with tertiary symptoms rarely exhibit hereditary syphilis, but are weakly, scrofulous, and rickety. Such children often die of consumption, or of tubercular meningitis.

When hereditary syphilis is derived from the father it sometimes happens that the mother remains uninfected, though her infant exhibits all the signs of the hereditary disease. It is a remarkable fact that a mother who has thus escaped infection during pregnancy may nevertheless be infected by nursing her infant, if an excoriation or fissure of the nipple permits the entrance of infected secretions from the child's mouth. Sometimes, however, a previously healthy mother is infected by her offspring before its birth.

It sometimes happens that the elder children of syphilitic parents inherit the disease, while the younger escape. This is due to the fact that with the progress of time the possibility of transmission gradually diminishes. Sometimes children are born alternately syphilitic and non-syphilitic. This is due to the fact that the disease is most infective and transmissible when actively manifested in the parents. During the period of latency children may be conceived without transmission of the infection.

It sometimes happens that in a previously healthy family the mother becomes infected during her pregnancy. Under such circumstances the infant is also sometimes infected directly from the blood of the mother, but sometimes escapes completely, and is born and remains healthy. It has been attempted to show that such infection can only take place during the first five months of pregnancy, but it is probable that there is no uniform rule in such cases. The numerous accidents by which an infant, though healthy before birth, can be infected during delivery, or in the act of nursing, render it extremely difficult to decide when, where, or how the contagion may have entered its tissues.

Symptoms and Diagnosis. The most common consequence of hereditary syphilis is abortion. The prematurely delivered fœtus is usually in a state of maceration and decomposition. This result is due to thickening of the walls of the umbilical vessels, and the formation of thrombi in the vascular canals of the umbilical cord. Sometimes gummy tumors and interstitial proliferation of the connective tissue of the placenta produce such obstruction to the passage of the blood that death of the fœtus necessarily results. The majority of abortions are thus explained, and it is an especially significant fact when miscarriages are often repeated.

When, however, a living child is born, death frequently follows in a short time as a consequence of marasmus and slow starvation. The infant rapidly wastes away, and presents a miniature counterfeit of extreme old age, emaciation, and death from exhaustion. The bones and the internal organs exhibit after death the characteristic changes of syphilis.

Sometimes, however, the newborn child presents at first the appearance of perfect health, but presently the symptoms of disease and obstruction in the nasal passages appear. A muco-purulent discharge trickles from the nostrils; breathing is rendered difficult, and nursing is almost impossible, since the child cannot respire through the nose during the act of suction. Condylomata frequently make their appearance in the corners of the mouth, and roseolar or papular eruptions become visible upon the surface of the body. The papular forms of eruption assume the characteristics of the condyloma, and are developed in the same localities that are principally affected in cases of ordinary, secondary syphilis. Bullous and pustulous syphilides are also frequently encountered. Pemphigus is not uncommon upon the palms of the hands and soles of the feet; and in the mouth and throat various lesions of an erythematous, roseolar, and condylomatous character are manifested. A peculiar notching of the teeth has been described by Hutchinson as characteristic of hereditary syphilis (Fig. 82), but it is

FIG. 82.



Notched teeth. Malformation of permanent teeth found in hereditary syphilis. (MR. JONATHAN HUTCHINSON.)

certain that this conformation also occurs in cases where there can be no question of syphilis. The roots of the nails are sometimes involved in a paronychial inflammation, and in many cases the epiphyses of the bones are painful. Iritis is usually one of the later manifestations of hereditary syphilis.

Hereditary syphilis sometimes completes its course with the manifestation of the lesions of the secondary stage; but in many cases tertiary symptoms also appear during the period of second dentition or at the age of puberty. The local lesions and symptoms that are produced in the different organs of the body by tertiary syphilis all find their counterpart in the later manifestations of hereditary syphilis. In many cases the disease can be differentiated from tuberculosis only by the absence of tubercle bacilli in the secretions, and by non-reaction with tuberculin.

Hereditary syphilis sometimes exists as the unsuspected cause of diseases that are unusual among children—*e. g.*, ascites. In many cases there is gradual failure of the health, emaciation, and loss of strength without any definite cause for such disorders; and death may be thus produced as a consequence of progressive exhaustion.

The first symptoms of hereditary syphilis are usually manifested after the third week from the birth of the child. If the health remains intact for six months, it is not probable that the disease will subsequently appear. Cases in which hereditary syphilis is said to be first apparent at the age of puberty or later, are usually cases of tubercu-

sis, or patients in whom the early stage of hereditary syphilis was verlooked during infancy.

Pathological Anatomy. Among the most important changes hat are caused by hereditary syphilis is a disease of the epiphyses of he long bones and the cartilaginous extremities of the ribs. The issues between the shaft of the bone and the epiphysis undergo an regular proliferation and softening, which sometimes produces a separation of the epiphysis from its shaft. This disorder may be frequently ecognized by an audible crepitation when pressure is made with the nger over the site of the morbid process. When the bones of the extremities are thus affected their movement is attended with pain and ifficulty, so that the appearance of paralysis is closely counterfeited. n the serous cavities of syphilitic children who were born dead, serous ffusions are often discovered, and the serous membranes exhibit every ariety of thickening, contraction, and adhesion. The internal viscera xhibit all the changes that have been previously described as a consequence of tertiary syphilis.

Prognosis. The prognosis in hereditary syphilis is always of a ost serious character. Death frequently occurs as a direct consequence of the disease, and if life be prolonged, it is often rendered iserable by manifold diseases involving any or all of the organs of the ody.

Treatment. In order to prevent the transmission of syphilis as an ereditary disease, marriage should not take place within three years fter an original infection, and then only after at least six months of omplete recovery have been experienced. The renewal of any symptoms of the disease on the part of either parent should be followed at nce by an active course of treatment. If a healthy mother should ive birth to a syphilitic infant, she should be warned of the danger hat attends the act of suckling her child, and every precaution should e taken to prevent erosion of the nipple, through which infection might ake place. She should also take iodide of potassium in five-grain oses, three times a day, partly as a possible prophylactic, and partly r the purpose of medicating the milk with which the child is nourhed. If a wet-nurse be provided for the infant, similar precautions ould be observed. If a syphilitic mother should give birth to a althy child, under no circumstances should she be allowed to nurse infant, since it might be easily infected, if condylomata or bleeding ures exist about the nipple. The occurrence of maternal syphilis ing pregnancy should be the signal for active inunction with mercuointment.

o an infant in whom are apparent the symptoms of hereditary ilis should be given three times a day the tenth of a grain of calo- rubbed up with a grain of sugar of milk. The mouth should be hed after each period of nursing with a 2 per cent. solution of chlo- of potassium. Some physicians prescribe daily baths containing rosive sublimate, but if these are employed great care should be en to avoid the entrance of the bath water into the eyes or mouth the infant. A wooden tub should be used, since the mercurial solun would be likely to attack a metallic container. Exuberant papules

upon the surface of the skin may be successfully repressed by sprinkling them with calomel powder. Tertiary lesions should be treated with iodide of potassium. External ulcerations are to be dressed with mercurial plasters; and lesions of the mucous membrane should be frequently touched with iodized glycerin.

CHAPTER XIV.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.

THIS disease is an acute, epidemic, infective inflammation of the meninges of the brain and spinal cord.

SYMPTOMS AND COURSE OF THE DISEASE. Cerebro-spinal meningitis is ushered in abruptly by severe chills and headache, often accompanied by vomiting. The temperature rises to 101° or 102° F.; the fever is irregular, often intermittent or remittent. The patient is frequently delirious, there is rigidity of the spinal column, the head is retracted, the limbs are stiffened and drawn up toward the body; with young children there may be convulsions. The patient is greatly agitated, striving to get out of bed, crying and shouting. All the symptoms are aggravated at night. This is the *congestive stage* of the disease, consequent upon the commencement of inflammation. The existence of nervous irritation, after the expiration of from one to three days, manifests itself by an eruption of sudamina or of herpetic vesicles about the mouth. The expression of the countenance indicates pain, the face is pale, the eyes are red, the skin is dry and roughened by the spasmodic condition of the cutaneous muscular fibres. Petechiæ spots and various roseolous eruptions make their appearance, the pupils of the eyes are contracted, sometimes there is strabismus.

As the process of meningeal effusion advances, the symptoms of cerebral compression and depression appear. The patient becomes dull and stupid, no longer giving audible utterance to his sufferings; the countenance becomes dull and expressive of stupor, sensibility diminishes, the pulse becomes less frequent, and the respirations increase in number. The bowels are constipated, and there is retention of urine. As the disease advances stupor merges into coma, the pupils dilate, the ocular muscles become paralyzed, the limbs are agitated by spasmodic movements, which finally terminate in the quiescence of paralysis. The pulse becomes more and more frequent, compressible, weak, and irregular, though the heart may continue to palpitate violently. The respiratory movements do not correspond with the cardiac pulsations; they become irregular, less frequent, sometimes before death manifesting the phenomena of Cheyne-Stokes respiration. Cold perspiration appears upon the pale and livid skin, and death occurs in a condition of complete coma and exhaustion, sometimes preceded or terminated

by violent convulsions. Death may occur during the course of the first day, but the fatal termination is generally reached before the expiration of a week from the commencement of the attack. When not thus early fatal, the average duration of the disease is from twenty-five to thirty days.

A tendency to recovery is indicated by the cessation of convulsions, subsidence of excitement, return of natural sleep, recovery of consciousness, and the disappearance of fever. Convalescence is usually slow, and may be imperfect. Permanent loss of certain nervous functions is not uncommon as a consequence of the injuries inflicted upon the brain and spinal cord by the inflammatory process.

Varieties. Cerebro-spinal meningitis may be characterized by the predominance of certain symptoms in particular cases.

1. During the course of the epidemic the disease sometimes commences with the ordinary symptoms of irregular fever, headache, vomiting, stiffness of the neck, nervous excitement, and delirium; but after a day or two the symptoms subside with a critical perspiration, and convalescence is commenced.

2. *Apoplectiform* cerebro-spinal meningitis is characterized by sudden invasion, speedy loss of consciousness, violent chills, intense headache, rapid development of all the most active symptoms of the disease, and death within a few hours after the commencement of the attack.

3. In certain cases the characteristic phenomena are of *spinal origin*. The patient does not become delirious, nor is he comatose, but there is intense pain in the back and limbs, with muscular rigidity and contraction. A lingering death is preceded by exhaustion, wakefulness, and intense suffering.

4. In the *cerebral form* of the disease the prominent symptoms are those of cerebral excitement that continues from twelve to twenty-four hours, and is followed by evidences of effusion and compression of the brain, terminating in death. The spinal symptoms are few and insignificant.

Complications. The organs of special sense, the eye and the ear, are sometimes disorganized by the extension of inflammation to the internal structures of the eye and of the inner ear. The sense of smell is occasionally in like manner destroyed. The third, fourth, sixth, and seventh nerves sometimes become paralyzed as a consequence either of pressure upon their trunks, or of degeneration involving the nerve roots. Outside of the skull the serous membranes of the body not unfrequently become involved. Pneumonia is a common complication. The liver and the kidneys are also sometimes affected.

Pathological Anatomy. The characteristic changes that are produced by epidemic cerebro-spinal meningitis, are inflammation of the pia mater and a sero-purulent exudation upon the meninges of the brain and spinal cord. Even in cases of speedy death, microscopical examination indicates the presence of leucocytes along the vessels of the brain. The lymphatic sheaths of the small vessels are filled with lymph-cells and red blood-corpuscles, while an exudation of small round cells may be discovered in the cortex of the brain. The cerebral ventricles are distended with liquid. There is an evident tendency to

encephalitis or to myelitis with abscess formation. When life has been prolonged to the usual limit of the disease, the cerebral veins and sinuses are distended with dark blood; the vessels of the pia mater are bordered by the products of exudation; the meshes of the network are occupied by a gelatinous liquid that contains fibrin and is composed of serum. The longer the duration of the disease the greater the turbidity of the exudation by reason of increase in the leucocytes and pus corpuscles that float in the serous liquid. A similar exudation fills the ventricles of the brain. In cases of considerable duration the liquid becomes distinctly sero-purulent, and sometimes also contains red blood-corpuscles.

The arachnoid membrane exhibits little change, though it sometimes is covered by a layer of pus that has been poured out upon it. The superficial layer of the cortex of the brain is often œdematous and softened.

Similar evidences of vascular engorgement and sero-purulent exudation into the cavity of the arachnoid are presented by the membranes of the spinal cord. The products of exudation are more abundant upon the posterior surface of the cord than upon the anterior, and the increase in quantity as the lower extremity of the cord is approached. The cauda equina is often enveloped in a thick layer of pus. The cavities of the inner ear are sometimes filled with pus. The structures of the eye may be found inflamed, with pus in the anterior and posterior chambers of the organ. The iris, the cornea, and the conjunctiva may all be disorganized by the inflammatory process. The heart is sometimes softened; the pericardium may be distended by serous or sero-purulent exudation. Endocarditis is sometimes observed. The bronchi often exhibit evidences of inflammation, and pneumonia may also exist. The pleural cavity sometimes contains a more or less purulent exudation. The abdominal organs are rarely affected, though the kidneys may contain bacteria in the glomeruli, where they have caused degeneration and hemorrhage.

Etiology. In the exudations of cerebro-spinal meningitis are found a number of different bacteria which may be cultivated outside of the body, and which are fatal to rabbits. Micrococcus pyogenes aureus, staphylococcus aureus, streptococcus pyogenes, the pneumococcus, and other bacteria are numerous in the products of inflammation. The micrococcus of pneumonia appears to be the most common and efficient cause of special inflammation of the meninges; but it is probable that the presence of other bacterial forms gives character and variety to the clinical symptoms that mark the different forms of the disease.

The epidemic character that is exhibited by cerebro-spinal meningitis is exhibited in its frequent association with epidemics of influenza, scarlet fever, measles, mumps, and other eruptive fevers. Sometimes, however, such epidemic association has not been apparent. It is a disease that prevails epidemically during cold weather and in cold climates. It occurs chiefly among those members of the community who are compelled to live under unfavorable hygienic conditions. It attacks young children and young people by preference to those of more advanced age. It has been frequently observed among soldiers

and prisoners, among the pupils of boarding-schools, and among the tenants of other overcrowded and ill-ventilated habitations.

But the real cause of the prevalence of the disease lies in the activity of a communicable virus, which is transmissible and may be diffused under favorable circumstances, very much as the contagia of mumps and pneumonia are propagated.

DIAGNOSIS. The slight or abortive forms of the disease may sometimes fail of recognition, unless the acknowledged existence of an epidemic has quickened the perceptions of the attendant. Fully developed forms of the disease can be distinguished from *typhoid fever* by the irregular temperature, and by the frequent respiration that characterizes the meningeal disease. *Scarlatina* exhibits an elevation of temperature that is not observed in meningitis. From *tubercular meningitis* the disease may be distinguished by the violence of its symptoms and its rapid course, and by the absence of tubercular predisposition on the part of the patient. From *simple meningitis* a distinction may be very difficult, but epidemic tendencies and the extension of the symptoms over all parts of the cerebro-spinal axis, should determine the diagnosis of epidemic cerebro-spinal meningitis.

PROGNOSIS. The mortality from cerebro-spinal meningitis varies in different localities and in different epidemics. It may fall as low as 30 per cent. or it may ascend as high as 90 per cent. Among the symptoms of danger may be mentioned a weak, slow, and irregular pulse, rapid respiration, excessive dryness of the skin, great elevation of the temperature, and coldness of the extremities. Favorable symptoms are general warmth of the skin, perspiration, bright color upon the face, moderate rate of respiration, fulness and steadiness of the pulse. Delirium and somnolence are alarming symptoms. Coma, associated with depression of the rate of respiration, is a fatal symptom. Even after the establishment of convalescence recovery may be imperfect, entailing life-long misery or an early death.

TREATMENT. Few diseases are more intractable. In cases that are marked by violent headache and active determination of blood to the head, leeches may be applied behind the ears and cups to the spine. Cold compresses may be laid upon the head, but the application of ice is generally very disagreeable and increases the headache. Emetics and purgatives are useless. Ice and small doses of resorcin may be given for the relief of nausea and vomiting. Scrupulous cleanliness must be observed in order to prevent bedsores. The diet must consist of liquids administered by rectal injection, if the patient cannot swallow, or if the stomach is intolerant of everything. Alcoholic stimulants and external heat are useful in cases of prostration with coldness of the extremities. Mercury, iodide of potassium, and quinine are useless during the acute stages of the disease. The hypodermic use of morphine and atropine affords the greatest relief, and is followed by the largest number of recoveries. Chloral, bromide of potassium, and belladonna are recommended, but their utility is very doubtful in comparison with that of the opiates.

CHAPTER XV.

ERYSIPELAS.

ERYSIPELAS is an acute, infective disease characterized by active febrile movement, by an inflammatory eruption of variable intensity, involving the skin and subcutaneous areolar tissues, followed by desquamation and recovery, or by a fatal result that is dependent upon complications and the development of a typhoid condition.

The older authors have sought to establish a distinction between surgical erysipelas that occurs in connection with wounds or ulcerating surfaces, and a form of the disease that is chiefly manifested upon the cutaneous surface of the body, often without any obvious traumatism as an exciting cause; but this distinction can be no longer maintained. It is now believed that erysipelas is a unit so far as its nature and specific contagion are concerned. In the vast majority of cases the contagion finds entrance into the body through some solution of continuity involving either the external or the internal surfaces of the body. The symptoms that follow inoculation with the infective agent are varied in accordance with the locality that is affected, and with the predisposing conditions that influence the general condition of the patient. It is, moreover, highly probable that the contagion itself may exhibit different degrees of virulence produced by various conditions of growth and propagation. With the manifestations of the disease as it complicates wounds and the operations of surgery, the physician has nothing to do. For him the affection is only interesting as it involves the surface of the body or those organs that lie within the province of medicine.

SYMPTOMS. The course of the disease may be divided into three periods: 1. The stage of incubation. 2. The stage of invasion and eruption. 3. The stage of decline.

Incubation. The duration of this period varies from twelve hours to two weeks. During this time there may be a slight disorder of the general health, but ordinarily no characteristic symptoms precede the chill that ushers in the stage of invasion and eruption. The chill is usually long and severe, and is followed by a rapid elevation of temperature, which may in a few minutes rise to 104° or 105° F. The pulse is frequent, full, and strong; the tongue becomes covered with a thick, yellow fur, and there is severe headache, with pain in the back and limbs. From ten to twenty-four hours after the commencement of the chill, the seat of the future eruption becomes painful, and the lymphatic vessels and glands of the part are reddened and tender on pressure. In some cases this affection of the lymphatic system is less conspicuous than the simple cutaneous inflammation.

Eruption. The possibly unnoticed wound which has been the point of entrance for the infective agent now becomes the starting-point of

e eruptive process. The eruption is at first of a rose color, becoming idually of a darker hue, and spreading in every direction upon the rface of the body. The fever continues with a severity in proportion the intensity and amount of eruption. The temperature continues about 104° F., rising a little at night, and falling a little in the orning. In severe cases the fever is continuous. In milder cases it ay be either remittent or even intermittent. The course of the fever nd its severity depend upon the progress of the disease and upon the xtent of the complications that may arise. In mild cases the nervous ystem presents only the ordinary reactions of moderate fever; but if he infective process be extensive and virulent, there may be delirium r even convulsions, especially among children. Nausea, vomiting, diarrhœa, and bleeding from the nose are sometimes observed.

The eruption continues to extend by the enlargement of the circle that has the point of departure for its centre. As it advances, the portion of the skin that is recently invaded assumes a deep-red tint, while the part first attacked loses the intensity of its first eruptive color. The initial brilliancy of the eruption, at any given point upon the surface of the body, continues from two to five days, and then begins to subside, so that the advancing zone of active eruption leaves behind it a territory in which every stage of the receding eruption may be observed. The eruptive process extends like fire in the grass of a prairie, that burns as it goes, and leaves behind it a region of desolation upon which vegetation will reappear in the order of its destruction. Upon the white skin the line of demarkation between the eruption and the uninvaded portion is clearly defined; but upon portions of the body where the skin is naturally dark, as upon the scrotum, and in patients with a dark complexion, the line is not so well marked. The site of the eruption may, however, be easily recognized by the roughness and swelling f the skin, and by the vesicles and bullæ which are formed in the pidermis. Sometimes the cutaneous swelling is very considerable. his is most conspicuous where the areolar tissue is loose and abunnt. For this reason, when the face is the seat of the disease, the elids swell to such a degree that the eyes cannot be opened. The trils become in like manner obstructed; the mouth can scarcely be ned; the cheeks are enormously enlarged, so that the original linea- its of the countenance can be no longer recognized; the ears look f they had been thoroughly frozen and thawed. Even greater efaction and deformity accompany the development of the disease n it attacks the external sexual organs.

The eruption does not always progress in a continuous zone, but may t in separate and distinct patches. The course of the disease is etimes interrupted by apparent subsidence, followed by renewed vity. The period of eruption may thus be prolonged for several ks, until in certain cases the entire surface of the body has been olved. This form of the disease is called *migratory erysipelas*.

Erysipelas generally terminates in recovery, but in certain cases, tead of a gradual decline of the eruption and fever, there is an crease in the intensity of the disease. The pulse becomes rapid and brile; respiration grows more frequent; pulmonary complications

may appear; there is vomiting and diarrhœa; the tongue becomes dry and brown; there is constant delirium and nervous prostration, and the patient passes into the coma that terminates a typhoid condition. This unfavorable course of the disease is generally precipitated by previous alcoholic excess, and by a cachectic condition of the system.

Decline. The temperature falls rapidly to the normal point, and the pulse follows suit. The tongue becomes clean, thirst diminishes, appetite returns, natural sleep occurs, the swelling of the skin subsides, redness gradually diminishes, the vesicles and bullæ, which distended the epidermis, dry up and exfoliate. Sometimes the desquamation is very trifling and furfuraceous in character; in other cases the epiderm peels off in considerable flakes, leaving the new skin red and tender for a considerable time. As the brilliant color fades, it is succeeded by a yellowish or bluish tint, which continues for several weeks. The hair sometimes falls off, but is soon succeeded by a new growth. In the portions of the body where the skin is loose and thin, diffuse infiltration of the areolar tissue sometimes continues for a considerable period and may furnish a predisposing cause for renewed invasions of the disease. During convalescence the urine frequently contains a small quantity of albumin and epithelial casts from the kidneys.

In scorbutic and cachectic subjects subcutaneous hemorrhages sometimes accompany the eruption of erysipelas. The surgical varieties of erysipelas involve the deep tissues of the body, and frequently occasion extensive suppuration and gangrene of the parts that are involved. These forms of the disease are fully treated in surgical text-books.

The inflammatory swelling of erysipelas is not limited to a cutaneous surface alone. When the eruption appears upon the face it is not an uncommon event to find the nasal passages also invaded. The fauces, pharynx, larynx, and trachea may also be involved. Œdema glottidis may be produced by the resulting inflammation about the orifice of the larynx. Erysipelatous pneumonia may occur as a consequence of the extension of the disease from without, or as a consequence of invasion of the pulmonary circulation by infectious emboli. Under these circumstances the lungs become rapidly involved throughout their entire extent, and death soon follows. The alimentary canal may also be attacked by erysipelas, frequently extending into the mouth and pharynx from the face. It sometimes originates within those cavities, involving the tonsils, and extending to the submaxillary and cervical lymphatic glands. It may result in abscess or gangrene of the fauces and pharyngeal walls. The œsophagus escapes the ravages of the disease. A few cases have been recorded in which the disease has extended into the intestinal canal. The urethra and the bladder have been occasionally attacked, both in males and in females, and the extension of the disease throughout the whole course of the uterine passages is a not infrequent event. This, however, is a different thing from the puerperal inflammations that are produced by erysipelatous infection after delivery. Erysipelas communicated to a female patient at that time may cause one of the forms of puerperal fever; and, *vice versa*, the septic discharges of puerperal fever may cause erysipelatous inflammation if conveyed to a wound upon the person of a previously uninfected patient.

close relation between erysipelas and puerperal fever has been thus many times demonstrated.

Pathological Anatomy. Examination of the skin during the period of inflammation shows the margin of the eruption occupied by distended capillaries forming a zone of congestion. The process of exudation is more conspicuous as the central portions of the inflammation are approached. At first the *bloodvessels* are surrounded with leucocytes, which later become infiltrated throughout the areolar tissue of the skin. As the inflammation progresses, the cutaneous and subcutaneous tissues become swelled and infiltrated with serous and corpuscular exudates. The *lymphatic vessels* often share in the inflammatory process, which then follows the lymphatic canals in advance of the zone of congestion, producing a species of fringe-like process that pushes out into the healthy tissues, and may be felt by the finger in advance of the ridge-like border that marks the margin of the inflamed zone or patch. The *lymphatic glands* also share in the swelling that follows the invasive process.

Occupying the tissues along the margin of the advancing inflammation are numerous *micrococci*. These are streptococci, and they occur in pairs or in chains. They occupy the intervascular spaces, the lymphatic vessels and glands, and the fat cells of the adipose tissue. They appear to be identical with the forms of streptococcus pyogenes, and must be regarded as the cause of the disease. They are most numerous in the advancing border of the inflammation, and disappear from the tissues as the inflammatory swelling subsides.

In addition to the evidence of disease already mentioned in connection with the respiratory organs and the alimentary canal, *endocarditis*, *pericarditis*, and *inflammation* of the *walls* of the *bloodvessels* are sometimes observed. The *liver* is enlarged and dark in color; the *spleen* is also softened and sometimes enlarged; the *pancreas* remains healthy; the *kidneys* are frequently inflamed and reveal the presence of bacteria identical with those discovered in the skin. The serous membranes of the body, the *peritoneum* and the *pleural membranes*, are occasionally inflamed, and the serous cavities of the *joints* are sometimes the seat of an inflammatory process which may be considered, when purulent in character, as a manifestation of general septicæmia.

Diagnosis. Simple erysipelas is not difficult of recognition, unless it occupy the scalp or the internal cavities of the body, or portions of the skin that are deeply pigmented.

From *inflammatory rheumatism* it must be distinguished by the facts that rheumatism occupies the articulations; that the redness is restricted to the region of the joints, and is not as highly colored as in erysipelas.

Erysipelas may be confounded with certain cutaneous diseases, such as the various forms of *erythema*, which may be distinguished by the lower grade of fever; by the darker color of the eruption; by the local circumscription of the patches, and by their absence from the face. *Eczema* may be distinguished by the character of the eruption, which

is minutely vesicular, unattended by fever, and productive of much itching.

Urticaria may be distinguished by the transient character of the eruption; by the intense itching; and by the limited character of the tumefaction of the wheals and patches that form the eruption.

The various *eruptive fevers* may be distinguished from erysipelas by the history of the case, and by the characteristic eruptions as they appear. The phlyctenoid forms of erysipelas may sometimes be mistaken for *herpes* or *pemphigus*, but in herpes the eruption follows the course of the nerves; there is less fever, and neuralgic pain is intense.

PROGNOSIS. Mild, uncomplicated erysipelas is not often fatal. The gravity of the disease depends upon the condition and diathetic predisposition of the patient, and upon the epidemic influence that forms the environment. The disease is especially fatal among the intemperate, and at the extremes of life, particularly when complicated by chronic diseases of the heart, liver, and kidneys. The mortality varies from 1 to 50 per cent.

It is an interesting fact that certain diseases are sometimes benefited, if not cured, by the intercurrence of erysipelas. Insanity, rheumatism, asthma, neuralgia, dropsies of renal and cardiac origin, and various surgical diseases, are said to have been cured by an attack of erysipelas; but when the disease occurs as a secondary event, during the period of decline of other infective diseases, the effect upon the health is very unfavorable.

ETIOLOGY. It has been admitted that the contagion of erysipelas (*streptococcus*) must be introduced into the lymphatic circulation before it can become active in the body, and that it can only find access to the circulating fluids through some lesion of the skin or of the mucous membranes of the body. For this reason the disease usually occurs among wounded patients and the subjects of surgical operation. A minute scratch, vesicle, or pustule may afford entrance to the poison. The solution of continuity through which it finds entrance to the body may completely heal during the period of incubation; as may be sometimes witnessed after abortive attempts at vaccination, when erysipelas attacks the adjacent skin a few hours or days after the incisions have healed, and the insignificant scab has fallen.

Like other infective diseases, the occurrence of erysipelas is favored by cold, damp weather, and by unfavorable hygienic conditions of life. For this reason it is frequently associated with the prevalence of other epidemic diseases, especially among the inhabitants of new countries and overcrowded cities. Among individual predisposing causes may be reckoned the influence of age, sex, and period of life. It is very common among cachectic infants and among aged people. It is more frequent among men than among women. In short, its occurrence is proportioned to the frequency of traumatism or cutaneous lesions of any sort among the different members of the community.

TREATMENT. The indications for treatment are: 1. To secure favorable hygienic surroundings; 2. To make such local application as shall serve to retard the progress of inflammation, and add to the

comfort of the patient; 3. To administer such remedies as shall reduce fever, promote elimination, and prevent exhaustion.

Perfect ventilation of the apartment occupied by the patient must be secured. The diet must be liquid and agreeable. If the stomach rejects food, and the patient loathes everything, it is unnecessary to force nourishment upon him. Iced drinks and the sucking of ice often give more relief than anything else. If, however, the typhoid condition appear, it will be found necessary to give milk, egg-nog, and alcoholic stimulants as freely as possible. During the period of convalescence the diet should be gradually varied until the full allowance is reached.

The local treatment of erysipelas may be restricted to the use of emollient applications that exclude the air from the skin, such as vaseline, simple cerate, starch powder, lycopodium, oxide of zinc, or the subnitrate of bismuth. Resin cerate is valuable as a stimulant to the capillary circulation at the seat of eruption. Tincture of iodine and nitrate of silver have been recommended as local applications for the purpose of aborting the eruption; but frequent trials have demonstrated their inutility. Elastic collodion forms an excellent application when the region of eruption is not too extensive. Hypodermic injections of carbolic acid and other antiseptic substances have been practised with a view to the destruction of the bacteria that multiply in the skin along the margin of the advancing eruption; but the utility of this mode of treatment is exceedingly questionable, and it has been generally abandoned. Great relief is often obtained by spraying the face two or three times a day with the following solution:

℞.—Hydrarg. bichlorid. } Acid. tartaric. }	āā	gr. xv.
Alcohol.		℥jss.
Ether. sulphuric.		℥xvj.—M.

The eyes should be covered with borated cotton during the operation.

Punctures and scarifications of the skin are employed, chiefly in surgical erysipelas. The various antiseptic lotions that have been praised owe their principal efficacy to the cooling effect of their evaporation.

Since there is no safe antidote to the poison that produces the disease, very little advantage results from the administration of the numerous antiseptic remedies that have been recommended in the treatment of erysipelas. So far as they reduce the symptomatic fever and add to the comfort of the patient, they are useful; but beyond those limits nothing will be gained by activity in their exhibition. Antipyrine, acetanilide, and phenacetine may be administered for their febrifuge effects. Pain may be relieved by the use of opiates. Nausea and vomiting will often be controlled by the use of dilute hydrocyanic acid and the subnitrate of bismuth. Nervous exhaustion and a typhoid condition call for the administration of alcohol, strychnine, and tonic doses of quinine and iron, such as are furnished in the well-known elixir of iron, quinine and strychnine. Tincture of the perchloride of

iron has been extensively employed in the treatment of the disease, but its beneficial effects are of the rarest occurrence, and are in no way superior to the results afforded by more agreeable preparations of iron, or by dilute mineral acids. During the period of convalescence much benefit will be obtained from the administration of tonic and restorative drugs, associated with good diet and gentle exercise in the open air. Recently inflamed portions of the skin should be protected for some time from the direct rays of the sun and from strong winds when exposed out of doors.

CHAPTER XVI.

MUMPS—PAROTITIS.

An acute, epidemic, contagious inflammation of the salivary glands.

Symptoms. The *invasion* of the disease is attended by the symptoms of moderate fever. In addition to the ordinary headache that accompanies febrile conditions, there is complaint of pain and stiffness about the articulations of the lower jaw. High fever and nervous symptoms, such as convulsions, are rare. The tongue is coated, and the symptoms of catarrhal stomatitis may be observed within the oral cavity. Sometimes there is vomiting or diarrhœa. After a few days, a swelling in the region of the parotid gland becomes manifest, ordinarily upon the left side. This speedily occupies the space behind the angle of the jaw, displacing the ear upward and outward. The submaxillary and sublingual glands soon participate in the enlargement, and in the majority of cases the glands of the other side become involved. Movements of the jaw, and the effort of swallowing, become exceedingly painful. The head is held stiffly erect, or may be drawn backward, or toward the unaffected side if but one gland be affected. In severe cases the mucous membrane of the pharynx and larynx may swell to an extent that interferes with vocal utterance and respiration. The temperature rarely exceeds 102° F., subsiding as the swelling progresses, and ascending moderately with the invasion of the gland upon the opposite side.

The *duration* of the disease is quite variable. The period of incubation occupies one or two weeks; the swelling of the glands may occupy another week or more; and, if both sides become involved, the disease may continue for three or four weeks.

Occasionally the disease affects the *genital glands*. In the male sex orchitis may occur; with female patients some inflammation may occur in the mammary glands, in the ovaries, or in the glands about the vulva. These inflammations generally subside after a few days without unfavorable results, though partial atrophy of the affected glands is sometimes observed.

Diagnosis. During the early period of invasion it may be impossible to distinguish the fever of mumps from that by which other infec-

e processes are introduced; but with the appearance of swelling in parotid region, diagnosis becomes greatly simplified. From *tumors* olving the *submaxillary region*, it may be distinguished by the febrile vement and the rapid development of the growth. *Tubercular nds* in the neck occupy the sides of the neck and the submaxillary ion. The tumors of *lymphadenoma* are developed without fever, l their growth is more gradual than is the case with the parotid argement in mumps.

Etiology. The disease is propagated by a contagion, of which the ture has not been positively decided, though its bacterial origin can rdly be doubted. It is communicated by contact rather than through atmosphere; consequently its diffusion is not rapid nor as universal that of measles or scarlet fever.

Pathological Anatomy. The swelling of the salivary glands sults from the action of the contagion, which, probably, reaches the sues through the mouth and the salivary ducts. This excites an flammatory exudation into the connective tissue of the glands. This ually disappears by resolution, but in rare cases may progress to sup- ration or gangrene.

Prognosis. Recovery is almost universally the result. The rare currence of death must be referred to complications of the disease. f these, one of the most dangerous is meningitis.

Treatment. Active medication is quite unnecessary. Fever may e relieved by the use of antipyrine; and pain in the region of the arotid may be allayed by the use of opiates in small and frequent oses. The mouth and fauces should be frequently disinfected with a lution of chlorate of potassium, of boric acid, or Listerine, or the ermanganate of potassium. If agreeable to the patient, the face and eck may be anointed with vaseline, or with liniment containing bella- onna and aconite; and the swollen glands may be covered with warm annel or with cotton-wool. The patient should be kept in bed, and he food should be of a liquid character. Orchitis may be treated by upporting the inflamed gland in such a way as to prevent traction upon he spermatic cord. Local applications of a warm and anodyne char- cter may be employed as in the treatment of the enlarged parotid land itself.

CHAPTER XVII.

SECONDARY OR SYMPTOMATIC PAROTITIS.

This is an inflammation of the parotid gland that occurs as a com- lication of various infective diseases, such as pyæmia, the plague, phus, typhoid, relapsing and scarlet fevers, measles, dysentery, and holera. It is caused by a special infection of the parotid gland with a oison, probably the pyogenic cocci, that is propagated in the system uring the course of the primary disease. It usually affects but one of

the parotid glands, and at a late period in the course of the primary disease, or even after the commencement of convalescence. If the glandular swelling commence before the conclusion of the primary fever, the local changes alone attract attention. If the inflammatory process has been deferred until the period of convalescence, a renewed febrile movement may mark the commencement of the inflammation. The gland swells exactly as in epidemic mumps; but it soon becomes evident that the inflammatory process is not restricted to a simple serous exudation involving the connective tissue.

The tumor becomes tense, shining, hot, reddened, and painful. The formation of abscess is indicated by fluctuation followed by rupture of the skin and the discharge of pus. In some cases the substance of the gland becomes gangrenous. The process of suppuration sometimes extends into the neck, or may burrow among the muscles about the angle of the jaw, with rupture of the abscess into the mouth, the pharynx, the ear, or even into the anterior mediastinum. The bones at the base of the skull are sometimes involved in the destructive process. Thrombi may form in the jugular veins and in the sinuses of the brain. Such cases are almost inevitably fatal.

The *treatment* of secondary parotitis must be conducted in accordance with the requirements of antiseptic surgery. An early outlet should be secured for imprisoned pus, and the cavity of the abscess must be assiduously cleansed with antiseptic lotions and dressings. Nutritious diet and preparations of iron, quinine, and strychnine must be freely administered. Alcoholic stimulants may be sometimes required.

CHAPTER XVIII.

RÖTHELN—GERMAN MEASLES. RUBEOLA.

GERMAN measles is an epidemic, contagious disease, characterized by very slight fever and catarrhal symptoms, with an eruption of pink-colored spots that resemble in some particulars the eruptions of both measles and scarlet fever.

SYMPTOMS AND COURSE OF THE DISEASE. The period of *incubation* is of variable duration, lasting from seven to twenty-one days. The period of *eruption* is preceded by slight chills alternating with moderate fever, with loss of appetite, headache, and general discomfort which may continue for a few hours only, or may be prolonged for two or three days. Moderate catarrhal symptoms affecting the eyes and the mucous membranes of the nose and throat, produce an increase of secretion, watery eyes, and sneezing. Sometimes there is a trifling cough. The temperature rises to 100° F., or possibly in severe cases a degree or two higher, concurrently with the appearance of the eruption. The eruption appears first about the head and neck, and then invades the body and arms, appearing lastly upon the lower extremities, and

appearing in the same order. The entire period of eruption is about r days, and at no time does it cover the entire surface of the body. e spots are punctate, rounded, discrete, and of a pink color. Their e is variable, many of them resembling the punctate elements of the sh in scarlet fever, while others approach in size the maculæ of easles. They are but slightly elevated above the skin, and seldom sume the crescentic form. As they disappear, they fade more rapidly an the spots of measles. The tongue presents a white fur, and the embrane of the mouth and throat is slightly swelled and reddened, ith spots suggesting the appearance of the similar eruption in measles. he lymphatic glands in the sides and back of the neck and in other rts of the body are somewhat enlarged.

The subsidence of the eruption is followed by *desquamation*. This metimes escapes observation, and is often very trifling in amount. It ntinues for one or two weeks, and is generally in proportion to the nount of fever and the intensity of the eruption.

Catarrhal inflammations of the respiratory passages of the alimentary nal and of the kidneys are occasionally observed, but ordinarily the urse of the disease is mild and free from complications.

ETIOLOGY. Rubeola is propagated by a contagion which is probably ansmitted in the same way that the similar contagions of measles and arlet fever are conveyed. The exact nature of its active agent is not t known, but it undoubtedly belongs to the bacterial class of para- tic organisms. The disease prevails principally among children, for e reason that many adults have experienced its effects in childhood. has been thought to be a hybrid form of disease, sharing in the aracteristics of both measles and scarlet fever; but careful observa- on reveals its separate identity. It does not protect against either of e other diseases, and it does afford protection against itself.

DIAGNOSIS. The only diseases with which rubeola can be confounded e measles, scarlet fever, and the various forms of roseola. From *seola* it may be distinguished by the history of the case, by its epi- mic prevalence, and by its lack of connection with previous infection syphilis or by the ingestion of the drugs that produce roseolous uptions. From *measles* it may be distinguished by the general mild- ss of the symptoms, and by the absence of the coryzal and febrile mptoms that so long precede the eruption of measles. The rapid urse of the eruption, the lesser size of the spots, their brighter color d minor degree of elevation above the level of the skin, together ith the absence of the crescentic form of the patches, serve to differ- tiate the rash of rubeola from that of measles. Within the mouth d throat the appearances more nearly resemble those of scarlet fever an those of measles. From *scarlet fever* rubeola may be distinguished the brevity and mildness of the period of invasion, by the absence vomiting and elevation of temperature, by the lesser degree of sore- roat, and by the swelling of the glands about the sides and back of e neck instead of those at the angles of the jaw which are principally fected in scarlet fever. The eruption of scarlet fever is more uniformly unctate than that of rubeola, and the desquamation of scarlet fever

is far more extensive and flake-like than the fine, dusty exfoliation rubeola.

PROGNOSIS. The uncomplicated disease is never fatal. Compli tions affect the prognosis in proportion to their gravity.

TREATMENT. Rubeola seldom requires any form of medicati The little patients are not even confined to bed, nor do they req the attendance of a physician. Severe cases that have been rende such by the occurrence of complications may be treated in accorda with the rules laid down for the management of measles and of special diseases that may have become intercurrent.

CHAPTER XIX.

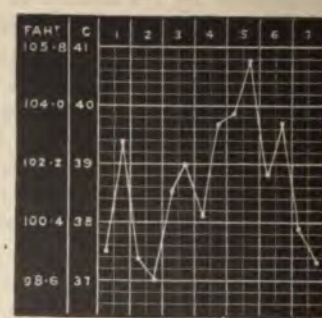
MEASLES—MORBILLI.

MEASLES is an epidemic, contagious fever, characterized by cor bronchitis, and a general eruption of slightly elevated, irregular, dened spots upon the entire surface of the body.

SYMPTOMS AND COURSE OF THE DISEASE. The evolution of mea is characterized by four successive periods: incubation, invasion, e tion, and desquamation.

Incubation. It is not possible to fix an exact and uniform dura for the period of incubation. It may vary from eight to fourteen d though its usual length is about twelve days During this time health may not be disturbed, but it is not uncommon to observe a tain degree of depression of spirits, accompanied by slight fever.

FIG. 83.



Temperature in measles. Fall of temperature after the first day's fever. Gre on the fourth day, with the appearance of rash. Maximum on fifth day, wit development of the rash. (WUNDERLICH.)

Invasion. This period is characterized by depression, mus pains, loss of appetite, sometimes by vomiting, by irregular chills fever, watery eyes, coryza, and a hoarse, dry cough. The conjun

njected, the eyelids are swelled, there is photophobia, and a copious
arge from the nasal mucous membranes; sometimes there is nose-
; sneezing is a frequent occurrence. The fever closely resembles
of acute catarrh; it rises at night and intermits in the morning.
temperature seldom exceeds 102° F., and frequently returns to
ormal point during the second day, rising again with the appear-
of the eruption. (Fig. 83.)

n the third or fourth day an eruption of circumscribed and slightly
minent patches may be discovered upon the soft palate and pillars
e fauces, and in the pharynx. This eruption appears from twenty-
to forty-eight hours before the rash can be discovered upon the
During this period the tongue is coated, there is thirst and
plete loss of appetite, but the bowels ordinarily remain in their
al condition.

ervous symptoms are usually limited to a feeling of prostration,
mpanied by headache; delirium is rare. Young children some-
s experience convulsions. The period of invasion usually lasts
three to four days. Sometimes only fever and coryza are present
out the occurrence of cough.

he *eruption* first appears upon the sides of the neck, upon the chin,
t the lips, upon the cheeks and forehead. It consists of semi-
lar, crescentic patches about the size of a grain of wheat, slightly
ated above the level of the skin, and of a deep-red color, which
ppears on pressure, but is renewed as soon as the finger is removed.
se patches sometimes remain isolated, but usually they become
luent to a degree that suggests the eruption of scarlet fever, espe-
y upon the face. Appearing upon the face and neck, it extends
nward over the body and the limbs, reaching the extremities in
twenty-four to forty-eight hours. By this time the earliest por-
of the eruption begins to decline; the spots lose their vivid color,
ide, and grow smaller. The color becomes dark and dull, and is
incompletely effaced by pressure. The decline of the eruption
any given portion of the skin occupies from three to five days.

uring the period of eruption the fever continues until the subsidence
e rash, reaching its highest elevation with the complete generaliza-
of the eruption; it rapidly subsides with the fading of the rash.
rrhal symptoms continue and sometimes are increased during the
d of eruption. Respiration is somewhat accelerated, there is
dant muco-purulent discharge from the nostrils, cough continues,
during the outbreak of the rash there may be a slight dyspnœa;
ptoms of bronchitis are present, caused undoubtedly by the occur-
e of the eruption upon the mucous surfaces of the body. During
in epidemics the effects of the eruption upon the mucous membrane
ie alimentary canal are sufficient to produce considerable diarrhœa
many patients. The duration of uncomplicated measles is about
or nine days, of which three or four are occupied by the invasion
the remainder by the eruption.

esquamation. As the eruption disappears the epidermis becomes
ched in the form of fine epithelial scales. These never assume the

magnitude of the epidermal shreds that are thrown off during the similar period in scarlet fever. They are sometimes scarcely noticeable.

VARIETIES. During the period of invasion the fever may be excessive. Coryzal phenomena may be greatly exaggerated. The cough may be excessive and suffocative, resembling the paroxysms of *laryngismus stridulus*. Diarrhœa may be present, and may become dangerously severe from the development of dysenteric symptoms. Vomiting may in like manner become a source of distress and danger. Intense headache, convulsions, stupor, and coma may cause great alarm, but these incidents are usually arrested by the appearance of the eruption. Sometimes the period of invasion may be prolonged for many days, and, on the contrary, it may be considerably abridged.

Eruption. The rash may be incompletely developed, remaining pale and indistinct, with a few spots visible upon the skin. In other cases the eruption may be intense and confluent. Its duration may be greatly abbreviated, with true disappearance of the spots in a few hours. It may appear upon the body before it is manifested upon the face. The spots themselves may sometimes become unusually prominent, without disappearance on pressure, indicating a certain amount of inflammatory exudation into the skin. Small vesicles surrounded by an areola appear among the spots of the normal eruption. A certain amount of cutaneous irritation is usually present. Catarrhal symptoms are sometimes almost completely absent. In like manner the fever is sometimes almost imperceptible in mild cases of the disease.

Malignant measles is characterized by great severity of fever, intense headache, repeated vomiting, violent diarrhœa, frequently by convulsions and coma. The temperature is high, the tongue dry and brown, and the patient may die before the appearance of the eruption. If life be prolonged, the eruption may be irregular in its appearance, and may be imperfectly developed or may assume the hemorrhagic form, characterized by a dark-purple color, and by the appearance of petechiæ and of hemorrhages from the mucous membranes. The patient usually dies in a few days, overwhelmed by the disease that runs its previous course with, or without, complications.

COMPLICATIONS. The complications of measles consist either in an exaggeration of the normal phenomena of the disease, or of the result of the direct action of the contagion upon the tissues, producing unusual phenomena, such as hemorrhage, gangrene, and infective diseases of the internal viscera. In addition to these complications, other diseases, such as diphtheria, scarlet fever, tuberculosis, etc., may become associated with measles.

The most frequent and dangerous complications of the disease are the various disorders of the *respiratory organs*. Capillary bronchitis and broncho-pneumonia, laryngitis and chronic catarrhal affections, are the most common among the respiratory diseases. Various forms of inflammation may invade the *mouth* and the *alimentary canal*. The diarrhœa that sometimes accompanies the fever may result in the establishment of chronic entero-colitis. Diseases of the *circulatory apparatus*, such as pericarditis, endocarditis, and phlebitis are rare, but have been occasionally observed. As in other infective diseases the blood

ay become incapable of forming a clot, and the red corpuscles lose a nsiderable portion of their hæmoglobin. Hence the tendency to emorrhage that is sometimes witnessed.

Dropsy is of rare occurrence after measles.

Among unhealthy children *gangrene* sometimes complicates the disase. It sometimes appears during the period of eruption, but more requently after its subsidence. It commonly attacks the mouth along he borders of the gums or in the cheek near the orifice of the duct of Steno. The lungs, the female sexual organs, the ears, and ill-nourished portions of the skin upon different parts of the body, may also become the seat of gangrene.

The *mesenteric glands* and the *bronchial glands* may become the seat of inflammation, and *tuberculosis* is a not uncommon consequence of measles. Subcutaneous *abscesses* and *pyæmic symptoms* are sometimes observed.

Transient *albuminuria* is not uncommon during the course of the disease. Actual *nephritis* is rare. Like other infective diseases, measles is sometimes followed by *paralysis*, involving more or less of the nervous system.

Chronic conjunctivitis and *chronic otitis* are frequent sequelæ of the disease. *Tubercular diseases* of the bones, joints, and other structures of the body, not unfrequently follow the course of measles.

Relapses of measles are occasionally observed. A mother may sometimes be seen in bed with her children, suffering a second attack, caused by the same contagion that has prostrated her offspring for the first time. This proclivity to the disease apparently increases with the lapse of time.

Diagnosis. During the period of invasion it is difficult to distinguish measles from *influenza*. Vomiting is usually more frequent in measles than in influenza, and the epidemic environment often throws light upon the probable character of the attack. From *typhoid fever* it may be distinguished by its more rapid progress, and by the early appearance of the characteristic eruption. The temperature curve is also different in the two diseases, as may be seen by a reference to the diagrams of temperature.

From *meningitis* the disease may be distinguished by the catarrhal symptoms. *Scarlatina* differs from measles by the absence of coryza, by the intensity of the fever, by the burning heat of the skin, by the constant elevation of the temperature, and by the diffused redness of the soft palate, tonsils, and fauces; while the redness of measles is more conspicuous in the pharynx. At a later period the eruption within the mouth, in measles, resembles that upon the skin, while in scarlet fever there is a uniform redness of the mucous membrane. *Smallpox* can only be considered as a possibility before the period of eruption. It may then be distinguished from measles by the minute, indurated, shot-like papules that can scarcely be confounded even with the rounded and slightly indurated papules that sometimes appear in measles. The eruption of smallpox soon becomes vesicular, while that of measles fever passes beyond the papular stage. The eruption of *scarlet fever* is punctate, and tends to become rapidly confluent, while the eruption

of measles, even though it be confluent, preserves its elevated, n and crescentic form. The eruption of measles is most cons upon the face, where that of scarlatina is less prominent. The the rash in measles is darker than that of scarlatina. The *vesicular*, and *other eruptions* that sometimes coexist with the measles, do not extend over the whole surface of the body, a thus be readily distinguished from similar eruptions of inde origin.

The papular forms of *erythema* sometimes appear upon th chest, arms, and backs of the hands. The eruption is sometir ceded by a trifling fever, but the other characteristics of mea absent.

Roseola and *German measles* often present a superficial rese to measles, but the febrile movement is less severe; catarrha toms are almost entirely absent, and the eruption is less pr above the level of the skin than in measles. Certain *syphilit tions* may somewhat resemble that of measles, but the hist course of the disease will soon enlighten the diagnosis. *Medici stances*, such as quinine, iodide of potassium, and the terebe preparations, produce eruptions, which, however, may be distir from measles by the absence of fever and catarrhal symptoms the cutaneous irritation that they produce.

Etiology. The contagion of measles is exceedingly diffusi may be transmitted through the atmosphere, and may enter t lation through the respiratory organs. This is the most commo of transmission. Few persons can inhale air infected by a suffe measles without thus contracting the disease. It may also be nicated by direct contact, and it has been caused by inoculat blood or with the secretions of a morbillous patient. When th mitted, the period of incubation is about nine or ten days. T tion follows about three days later. The effluvia of the patien to be infective from the commencement of the prodromic s until convalescence is fully established. In the blood and in t tions, especially in the nasal mucus, of patients suffering with may be found great numbers of *micrococci*, especially diploco a variety of streptococcus. These probably are the most imp the bacterial parasites which flourish abundantly in the flui infected person.

Pathological Anatomy. It is in the respiratory organs most conspicuous changes may be observed after death. *Infla* of the nasal passages, pharynx, trachea, and bronchi may exist w grade of intensity—from mere hyperæmia to ulceration and *Catarrhal pneumonia* is exceedingly common, while *lobar pn* is rare. *Abscess* and *gangrene* of the *lungs* sometimes occur; *losis* of those organs is not unfrequent. The *pleural surfaces* be involved. *Endocarditis* and *pericarditis* sometimes occu *blood* becomes impoverished, its fibrin diminishes, and th globin dissolves out of the red corpuscles. The *peribronch phatic glands* and the *mesenteric glands* become enlarged and the *spleen* is also enlarged. The *kidneys* rarely manifest sign

ease. *Inflammation*, *ulceration*, and *gangrene* of the *oral* and *pharyngeal cavities* have been observed in cachectic patients. The *mucous membranes* of the *alimentary canal* may exhibit evidences of inflammation, especially in the large intestine and in the rectum.

If *ophthalmia* or *otitis* have been present, the effects of these diseases will be apparent after death.

PROGNOSIS. Uncomplicated measles occurring in ordinarily healthy subjects is rarely fatal; its irregular, exaggerated, and complicated forms are exceedingly fatal. Very young children are liable to death from pulmonary and intestinal complications. Social misery, pre-existing cachexia, unfavorable conditions of weather and climate, add greatly to the dangers of the disease. It is consequently extremely fatal among soldiers and sailors who are frequently predisposed to scurvy, and in whom measles frequently assumes hemorrhagic and malignant forms. In such cases a mortality of thirty or forty per cent. is not uncommon. Under favorable conditions the mortality seldom exceeds two per cent. If, however, the sequelæ of the disease be taken into consideration the mortality may be estimated at about ten per cent. The incidence of measles, however, is not an unmixed evil, for functional nervous diseases and certain chronic skin diseases are frequently cured by its intervention.

When the disease becomes epidemic for the first time in a population that has never experienced its effects, the mortality is very great. Thus, at the Sandwich Islands, when it was first introduced, in 1848, ten per cent. of the population were swept away by the epidemic. At the Fiji Islands, in 1877, a similar first experience of measles destroyed 20,000 people in a population of little more than 100,000 souls. This great mortality was the result of complicating diseases rather than of the infective disease itself.

TREATMENT. Simple uncomplicated measles requires very little medication. Hygienic care and attentive nursing are the principal requisites. Milk, gruel, and thin broths should be used for nourishment. Moderately cool and abundant drink may be given to the patient, and occasional sponging with tepid water may be allowed if it be agreeable. The room should be darkened, and the eyes should be frequently bathed with warm water, to relieve the conjunctival swelling. Antipyrine in appropriate doses may be given during the febrile period. Dover's powder may be administered at night, to procure restful sleep. The cough may be alleviated by the ordinary mixtures for bronchial catarrh, but if the symptoms of capillary bronchitis are present, opiates should be avoided. In such cases large poultices should be applied to the chest, and ipecac may be given until the expectoration is copious. During convalescence the return to solid food should be gradual, and exposure to cold must be avoided. Errors in these particulars are often followed by intestinal and pulmonary inflammations that are frequently fatal.

Malignant forms of the disease demand more energetic treatment. If the fever be intense, with delirium and symptoms of nervous irritation, and if eruption be delayed, much benefit may be obtained from the use of baths. The patient may be placed in a warm bath, of which

the temperature is a little less than that of the body. The wet pack, with a sheet dipped in warm water, forms a very efficient means of inducing the eruption when that is unusually delayed. Convulsions during the period of invasion are ordinarily of trifling importance; if repeated they may be quieted with bromide of potassium and chloral. The same remedies will be found useful in the attacks of laryngismus that sometimes complicate the early period of the disease. Hemorrhagic symptoms require the administration of astringents, of which aromatic sulphuric acid is the most efficient. Typhoid tendencies must be opposed by the use of stimulants combined with milk and eggs, in the form of egg-nog. Premature recession of the eruption calls for the application of warmth externally, and for the administration of warm and stimulating drinks. Aromatic spirits of ammonia, spirits of chloroform, and the ordinary alcoholic stimulants will be of service in such cases. In the treatment of very young children opiates should be avoided as far as possible, in consequence of the susceptibility of such patients to the poisonous influence of opium. Complicated diseases must receive the treatment appropriate to each case.

CHAPTER XX.

SCARLET FEVER—SCARLATINA.

Scarlet fever is a contagious disease, characterized by high fever; by an eruption that continues about one week on the surface of the body; and by inflammation of the tonsils and the adjacent lymphatic glands. It is sometimes complicated with rheumatism affecting the joints, and is often followed by various sequelæ, of which the most important is inflammation of the kidneys.

Symptoms and Description of the Disease. The *incubation* of the disease is of variable duration. Children exposed to the contagion do not manifest the symptoms of infection with any degree of uniformity as to time. As a general rule, however, the duration of the period of incubation is from three to seven days. During this time the patient usually appears to enjoy ordinary health. Sometimes slight disorder may be apparent, but as a general thing the *invasion* of the disease is abrupt. The child may have been all day at play; retires to bed apparently as well as usual, and before midnight may be tossing in burning fever. Nausea and vomiting without previous evidence of gastric disorder, often accompany and mark the invasion of the disease. The pulse rapidly increases its frequency; the temperature rises to 105° or 106° F.; the skin feels hot and dry; the throat burns and is painful during the act of deglutition; the tongue is covered with a thin white fur, and is red at the tip and edges. Pulmonary symptoms are absent; the bowels are usually constipated. The patient seems dull and inclined to sleep; sometimes convulsions occur. At the

piration of twelve to twenty-four hours the *eruption* begins to appear. This consists of minute red points that are not elevated above the skin, and are separated, at first, by intervals of healthy epidermis. In mild cases they remain thus segregated, but in the severer forms of the disease these points soon coalesce, giving a uniformly scarlet appearance to the surface of the body. Sometimes the eruption presents a slightly purplish tint like that of raspberry juice. In certain cases the points of eruption are slightly elevated above the surface and may occasionally present minute vesicles at their apices.

The *eruption* usually makes its first appearance about the neck, whence it spreads to the face and over the surface of the body and the limbs. The face and the hands not unfrequently escape till a late period, or present a less vivid form of eruption than that appearing upon other parts of the surface. It is most conspicuous upon the cheeks, which frequently contrast their color with the persistent whiteness of the skin around the mouth. It also appears upon the pillars of the fauces and upon the soft palate. In general terms it may be described as most abundant where the skin is the thinnest. Although the eruption does not rise above the level of the surface, the skin is somewhat tumefied by its occurrence; the face and hands and feet consequently appear somewhat swelled. This swelling disappears with the eruption and must not be confounded with the subsequent rheumatic swelling of the joints.

The *evolution of the eruption* occupies from one to three days. It remains fully efflorescent for about twenty-four hours, and then gradually subsides during an equal period of two or three days. During the whole of this time the patient complains of considerable itching and burning of the skin. This is a source of much discomfort.

During the first day the tongue remains moist and covered with a white fur, which gradually disappears by the fourth or fifth day, leaving the organ red, swollen, and covered with prominent papillæ, somewhat resembling the surface of a strawberry, whence the term *strawberry tongue* that characterizes this phase of the disease. As the eruption subsides the tongue becomes reduced in size, the papillæ disappear, and the normal covering of epithelium is gradually restored. The tonsils are more or less swelled, and the orifices of the mucous follicles are visibly filled with muco-purulent secretion. The sub-maxillary and cervical lymphatic glands share in the tonsillar enlargement. The burning *fever* that marked the commencement of invasion continues to increase with the progress of the eruption. It frequently reaches 105° or 106° F., and continues at an elevated point until the subsidence of the eruption. *Defervescence* is not sudden, but is gradual, with morning remissions and evening exacerbations. The course of the pulse is parallel with that of the temperature, rising rapidly at the commencement of the fever and sinking gradually with its subsidence. In like manner the respiratory movements are accelerated and retarded with the course of the fever. The respiratory passages are usually healthy, though the extension of the eruption into the nasal and pharyngeal orifices causes a moderate coryza which, in severe cases, may lay the foundation of intense inflammation and

ulceration. During the eruptive period the urine presents only the characteristics of the febrile state. It is scanty, high colored, and charged with urates and phosphates.

Desquamation. As the eruption disappears, exfoliation of the epidermis begins. After an intense fever with abundant and vivid eruption, desquamation commences, even before the complete disappearance of the eruption. The surface of the skin becomes dry and rough; minute scales composed of dead epithelium are thrown off; sometimes the epidermis is detached in considerable flakes; occasionally it is thrown off in large casts from the hands and fingers, after the manner of a serpent shedding its skin. Occasionally the hair and the nails are thrown off during the period of desquamation. In mild forms of the eruption desquamation is very trifling and soon completed, but when the eruption has been copious, with a high fever, it may be prolonged for six or eight weeks. Ordinarily it is completed within three weeks. Where the skin is thick, as upon the hands and upon the feet, the epidermal flakes are large and glove-like, while upon those portions of the body where the skin is thin and delicate it assumes a furfuraceous character like that of measles.

Irregular Forms of Scarlet Fever. Though scarlet fever usually follows the lines of evolution just indicated, it often appears in irregular forms. No disease can be more variable in its intensity. It may assume a form so insignificant as to be almost beneath recognition; or again, it may manifest itself as one of the most violent and fatal of diseases. Sometimes the period of invasion is almost absent; there may be no fever, and the eruption may be the first symptom of the disease. The eruption may, in certain cases, be entirely absent, or be so insignificant as to escape observation. In other cases the period of invasion is prolonged for a number of days. Sometimes there may be severe nervous symptoms, such as delirium, convulsions, stupor, difficulty of breathing, all of which disappear when the eruption breaks out. In some cases the rash does not cover the whole body, but appears in irregular patches, which are frequently of a purple hue, instead of the normal scarlet of the benign form of the eruption. Such cases are often attended by severe and dangerous nervous symptoms terminating in death. This form must be distinguished from mild cases with discrete eruption in which the punctate spots are separated from one another by intervals of comparatively healthy skin. *Hemorrhagic forms* of the disease are characterized by petechiæ, or even by ecchymotic patches. In certain rare cases the first eruption may disappear and may be followed, after a few days, by a second, or even by a third eruption. Such relapses after apparent recovery may sometimes prove fatal. The condition of the mouth and the throat may, in like manner, vary with the different forms of the disease. The whole lining of the mouth and throat may be swelled, scarlet in color, presenting evidences of acute inflammation in the tonsils and about the fauces. After two or three days the tonsils, and sometimes the pharyngeal walls, become covered with a white or gray exudation. This may penetrate into the submucous tissues, causing the development of abscesses in the tonsils or in the adjacent tissues, burrowing deeply into the neck. The lym

natic glands outside of the cavity of the mouth and of the pharynx are in the inflammation, sometimes causing immense swelling of the neck, with a brawny hardness like that of uncooked bacon. This process of glandular tumefaction progresses gradually, and does not subside with the disappearance of the eruption. It is due to an intense grade of blood-poisoning, and may lead to the most serious results.

Catarrhal inflammation of the *bronchial mucous membrane* and of the *gastro-intestinal mucous membrane* are sometimes observed as complications of the disease.

Malignant Scarlet Fever. The term malignant is applied to those forms of the disease that are characterized by excessive intensity, by an unusual sequence of symptoms, by excessive prostration, or by the occurrence of severe and unusual complications. Sometimes the patient *dies suddenly*, after a very brief period of invasion characterized by intensity of fever, violent headache, severe vomiting, delirium, and coma. In young children convulsions are extremely liable to accompany this form of the disease. In other cases the patient sinks rapidly into a *typhoid condition*, characterized by dry and brown tongue, weak and rapid pulse, distention of the abdomen, dilatation of the pupils, stupor, coldness of the extremities, irregular distribution of bodily heat, complete collapse, and death. These cases are very frequently complicated with *hemorrhages* from all the orifices, and into all the tissues of the body. In other cases violent vomiting and diarrhœa rapidly prostrate the patient, who soon dies in a *state of collapse*. Occasionally the disappearance of eruption and the subsidence of fever are speedily followed by the symptoms of *meningeal inflammation*, which soon terminates the life of the patient. *Catarrhal inflammation*, involving the respiratory passages and the alimentary canal, has already been mentioned among the complications of scarlet fever. A kindred form of inflammation attacking the *renal structures* is frequently observed among the sequelæ of the disease. It is more frequent in certain epidemics than in others. It may follow the mildest forms of the disease as well as severer cases. Its occurrence may sometimes be the first indication of the existence of scarlatina in an individual case that has been characterized by absence of the usual eruption. As a complication it occurs more frequently after scarlet fever than after any other disease. It often manifests itself in cases where every precaution against exposure to the usual causes of nephritis has been taken. In other cases it is absent, notwithstanding every possible degree of negligence. It occurs during the period of desquamation, and sometimes is ushered in by fever, headache, nausea, and vomiting, and the usual symptoms of an inflammatory fever. In other cases the appearance of *anasarca* is the first symptom that attracts attention to the condition of the kidneys. This complication will be fully considered in connection with diseases of the kidneys. It occasionally happens that inflammation may attack the *pericardium* or the *endocardium*. This complication frequently occurs in connection with articular inflammations which are usually attributed to rheumatism. *Scarlatinal rheumatism* is generally observed as the eruption disappears. It attacks the joints of the fingers and wrists; is usually quite transient in its duration, but may sometimes become

merged in a process of intra-articular suppuration. Such abscesses are, however, to be considered as local manifestations of *pyæmia*, which occasionally occurs as a sequel of scarlet fever.

Gangrene may also in rare instances occur as a sequel of scarlet fever. It is most commonly observed among ill-fed children, and other victims of cachexia. It may attack the extremities of the fingers or of the toes, the tips of the ears, the point of the nose, the lips, the tongue, the external sexual organs, and portions of the body subjected to unusual pressure in bed; it may invade the larynx, the eyeballs, the intestinal canal, the tissues of the lungs, and the areolar tissue of the neck. Among the most dangerous complications of scarlet fever must be reckoned *diphtheria*. It may occur as an exaggeration of the severer forms of tonsillar and pharyngeal inflammation; and it may be difficult to distinguish between the two diseases. It may also occur, apparently, as a sequel to scarlet fever; in which case, however, it should be regarded as an independent disease, following rapidly after the subsidence of scarlatina. Such concurrence of the two diseases adds greatly to the risks of the patient. More than fifty per cent. of such cases prove fatal.

Like other infective diseases, scarlet fever is sometimes followed by various forms of nervo-muscular disease. *Neuralgia* and *neuritis* are common, and the muscles of the neck may become involved, producing *torticollis*.

As scarlet fever is frequently followed by other diseases, so it also may occur as a secondary disease. It may thus become associated with measles, whooping-cough, typhoid fever, and other eruptive diseases. It may occur after wounds, or surgical operations, or after childbirth, even where no apparent exposure to its contagion can be discovered.

DIAGNOSIS. Scarlet fever may be distinguished from simple sore-throat by the eruption, which is lacking in faucial inflammation. *Tonsillitis* usually commences upon one side, while the faucial eruption of scarlet fever is bilateral and universal. From *diphtheria* it may be distinguished by the more abrupt commencement, and by the character of the eruption upon the surface of the body. From *measles* it may be distinguished by the absence of coryza and cough, and by the character of the eruption, which is punctate, instead of being papular, and is not elevated above the level of the skin. In measles the eruption is slightly elevated, is crescentic in the arrangement of its papules upon the sides of the neck, and covers the whole face up to the borders of the lips, while the eruption of scarlet fever generally respects those parts. Some difficulty may occur in cases of scarlet fever complicated by catarrhal symptoms; but these are rare, and the course of the disease will soon clear up the diagnosis.

Roseola and *German measles* resemble scarlet fever in the form of the eruption, but they are much less severe. Their duration is less, and the subsequent desquamation is very trifling in comparison with that of scarlet fever. *Certain drugs* may produce eruptions which closely resemble that of scarlet fever. Belladonna, hyoscyamus, stramonium, and antipyrine may thus produce an eruption closely resembling that

the infective disease; but the history of the case and its course l soon clear up the diagnosis.

ETIOLOGY. *Scarlet fever* is communicated by means of contagious rticles that are given off from the body of the patient during the tire course of the disease and until the cessation of the process of squamation. The contagion may be carried by the atmosphere to a ort distance. It may be transmitted to indefinite distances by adhe- on to articles of clothing and other things that have been in contact ith the patient. It is readily absorbed by milk, which has thus equently become the vehicle of transmission from infected localities to nsumers of the article. The duration of the period during which con- gion may be given off by a convalescent patient is extremely variable. ell-authenticated cases are recorded in which patients were infective r two or three months after the original attack.

Though dependent upon contagion for its propagation, the disease is uch more prevalent during cold and damp weather than during the ld season of the year. Its fatality is greatest during the severe eather of the winter months. Extremes of every kind that affect the eather serve to increase the fatality of the disease.

The epidemic prevalence of scarlet fever in a population where it is nstantly present, follows a very regular course. Epidemic waves llow one another at intervals of five to seven years, each epidemic riod requiring about two years for its complete evolution.

Scarlet fever is a disease that prevails in cold climates. If the con- gion be transmitted to the tropics it speedily loses its activity, and e disease does not become epidemic. It is said that it has never pre- iled in Japan. In certain countries its fatality is greater than in hers, as in England it is more dangerous and deadly than in France.

All ages and sexes are subject to the disease, though it is rare among rsing infants. It is also uncommon among adults, though principally r the reason that many of them have experienced the disease in child- od. It is most common among children from three to ten years of e. The lymphatic temperament seems to act as a predisposing cause the disease.

Not all who are exposed to scarlet fever will contract the disease. obably not more than fifty per cent. in any community are susceptible the contagion. The cause of this immunity is not understood, but existence is certain. For this reason the supposed effect of specific edies as a means of prevention and protection against the disease is dered very questionable. Various drugs have been administered for phylactic purposes, but their apparent success is for the most part to natural immunity on the part of so many members of the com- nity. When the disease appears in a family of children, it is not sual to observe its tardy manifestation among the members of the ily, with long intervals between the successive cases, although no rts may have been made for separation of the healthy from the . Something more than mere exposure to the contagion seems to necessary in many cases.

Bacteriological examination of the tissues, after death from scarlet er, reveals the presence of numerous forms of bacteria. Of these,

the most common is a variety of *streptococcus pyogenes*. It is yet possible to say that this is the only active agent in the contagion of disease, but it certainly is one of the active agents.

PROGNOSIS. Simple, uncomplicated scarlet fever is not dange Its mortality does not exceed four to six per cent. But the malig and complicated forms of the disease are exceedingly fatal. In tions of danger are furnished by convulsions, by excessive vomiting high fever, intense, irregular, and livid eruptions, especially if ac panied by petechiæ or hemorrhages. Great prostration and the ty condition, stupor, severe complications—especially diphtheria, py suppuration in the neck, purulent accumulations in the pleural c or in the articulations, cardiac disease, albuminuria, and anasarca indicate great danger. Secondary forms of the disease that subsequent to childbirth, wounds, or surgical operations, are dangerous than the primitive form of the disease. Children unde years of age experience a higher degree of mortality than older sons.

PATHOLOGICAL ANATOMY. The seat of the eruption in scarlet is in the network of lymphatic vessels beneath the epidermis. I involves the capillary vessels of the skin, causing hyperæmia a exudation between the layers of the epidermis. In this way is pro the swelling of the skin which marks the severer forms of the eru The distention of the capillary vessels produces the punctate appe of the early stage of the eruption, and its confluence in the com evolution of the rash. So long as the capillary vessels remain i the eruption may be made to disappear on pressure; by their ruptu produced local hemorrhages, petechiæ, and ecchymotic spots. eruption subsides, the lymph that was effused between the layers epidermis is absorbed, the external epithelial layer dries and be separated from the deeper portion. By this process, *desquama* effected. By a similar process the *tongue* parts with its fur, a *fauces* and *pharyngeal cavity* present the characteristic changes th witnessed. In severer cases, stomatitis, ulceration, and gangren occur in the cavities of the mouth and throat. Similar changes n noted in the mucous membranes of the alimentary canal. *P patches* and the *mesenteric ganglia* are frequently enlarged; the the *pancreas*, and the *spleen* are also increased in volume. Th sometimes exhibits evidences of inflammation. The cavities *joints* present changes identical with those produced by inflamm rheumatism. The *serous cavities* of the body are frequently oc by a serous transudate during the course of the anasarca that is by a nephritis; they may become inflamed, and they may con purulent exudation. *Endocarditis* and *myocarditis*, like those ing rheumatism, are occasionally discovered. The *kidneys* rarel sent any evidence of disease before the period of desquam Their inflammation is usually of the catarrhal form, involvin epithelium of the uriniferous tubules. Interstitial inflammatio volving the arteries, lymphatics, and veins of the organ, is not uncom In the *respiratory organs* coryza is comparatively frequent; lary bronchitis, and pneumonia are occasionally observed. The Eust

ıbe and the auditory passages may become involved by continuity with he nasal and pharyngeal cavities. *Meningitis, meningeal dropsy, ædema* of the *brain*, and similar conditions of the *spinal cord*, have been occasionally observed; but the majority of the nervous disturbances that complicate scarlet fever leave slight traces visible after death. The *blood*, as in other infective diseases, is indisposed to coagulate, and its hæmoglobin is largely dissolved out of the red corpuscles.

TREATMENT.—The general course of nursing in scarlet fever is more important than its medication. The patient should be isolated, and should be kept in bed, even though the case be of a mild character. The diet should be liquid, and an abundance of water must be supplied for drinking. The itching of the skin, which forms so unpleasant an incident, may be greatly relieved by gentle friction with any oleaginous substance. The surface of the body, during the febrile stage, may be frequently sponged with water of the temperature that is most agreeable to the individual, and may then be lubricated with oil or vaseline. Mild cases require little or no medication, unless it be some gentle hypnotic in order to aid sleep at night. Restlessness and nervous irritability may be relieved by frequent exhibition of minute doses of opium or its derivatives. Vomiting generally ceases with the appearance of the eruption, and may be relieved by the use of ice and lime-water with, or without, milk. If vomiting persist or occur at a late period of the disease, it is an evidence of nervous complications, and may require more energetic treatment. In such cases bromide of potassium may be used with benefit. Fever may be treated with antipyrine or with phenacetine. Antipyrine is the preferable drug for young children on account of its solubility, but it must not be pressed to the point of producing nausea or excessive reduction of temperature. If the temperature rise above 103° F., the safest and most efficient method of treatment consists in the use of cold water. Cold shower-baths and immersion in a cold bath cause excellent results, but popular prejudice renders this method difficult of application in private practice. In such casas the application of cold, by means of a wet sheet or by the use of Leiter's coils, secures the result with less antagonism from the public. The inflammation that occurs about the fauces requires but little treatment in mild cases. A solution of chlorate of potassium is generally sufficient. Patients who are old enough to gargle may use such a solution, or a one per cent. solution of chloride of sodium as a gargle. A two per cent. solution of boric acid in glycerin may be painted over the fauces every two or three hours. Vaseline similarly charged with the acid is very useful. Younger children may have their throats syringed with these solutions as frequently as may be necessary to prevent accumulation of decomposing secretions. For purposes of disinfection a solution of boric acid, of borax, or of permanganate of potassium are among the safest and most efficient. Eucalyptol and Listerine, which contains both eucalyptol and boric acid, are of considerable value. Swelling of the neck must be treated with poultices, and in accordance with the general principles of surgery. Coryza, otitis, and all inflammatory complications connected with the naso-pharyngeal passages, should be treated with great

assiduity in order to prevent destruction of the auditory apparatus. Intercurrent diseases require the treatment appropriate for each one. Rheumatism seldom needs any special attention beyond the application of anodyne liniments, and protection of the affected joints by wrapping them with flannel and oiled silk. During convalescence the process of desquamation may be aided by frequent inunctions with vaseline, and by the use of soap containing eucalyptol, or salicylic acid, or boric acid. Constipation must be prevented; the patient must be guarded against cold; and the urine must be frequently examined in order to obviate the danger of nephritis. The treatment of inflammation of the kidneys will be considered in connection with the diseases of those organs.

CHAPTER XXI.

WHOOPING-COUGH—PERTUSSIS.

WHOOPING-COUGH is an epidemic, infective catarrhal affection of the respiratory organs, characterized by a peculiar spasmodic cough.

SYMPTOMS. The course of the disease may be divided into four stages: 1. The stage of incubation. 2. The catarrhal stage. 3. The spasmodic stage. 4. Decline and convalescence.

Incubation. The stage of incubation varies from six to fourteen days.

Catarrhal stage. This stage is ushered in with the symptoms of an ordinary cold. There may be slight fever, headache, and depression, sneezing, chilliness, and a moderate degree of swelling of the eyelids with suffusion of the eyes. These symptoms may continue for a variable period of time, lasting from two days to three weeks or more, without the occurrence of anything decisive regarding the nature of the cough. If, however, it be unusually harassing and intractable, and especially if it be more frequent and irritating during the night than during the daytime, the probability of whooping-cough may be suspected.

Spasmodic stage. The paroxysms of the cough now become more violent and protracted, though sometimes less frequent than during the catarrhal stage. During the intervals between the paroxysms the patient may appear to suffer comparatively little, but the advent of each paroxysm is preceded by a sensation of præcordial distress and of irritation in the larynx and trachea. The movements of respiration then become accelerated, irregular, and restricted in their duration. The little patients seem to stifle their cough until it can be no longer restrained. They instinctively cling to their mothers or nurses, or seek to support themselves by grasping the furniture or anything within their reach. The paroxysm of cough finally explodes with a series of successive expiratory spasms, until the lungs are emptied of all the air that can be expired. The face becomes purple and swelled;

yes are reddened, and appear as if about to spring from their
ts; the superficial veins of the head and neck become prominent;
eart beats violently; perspiration breaks out over the head and
portion of the body, and suffocation appears to be imminent.
expiratory spasm is immediately followed by a few partial attempts
spiration, instantaneously succeeded by a long, noisy, whistling
p that fills the lungs with air and terminates the first stage of the
tysm. A number of similar spasmodic respirations follow; usually
nuing until a quantity of glairy, viscid mucus is expectorated
the pharynx; or until, as sometimes happens, the contents of the
ach are evacuated by vomiting. The paroxysm is thus terminated
a duration of one or more minutes. The patient seems then to be
ctly relieved, and resumes his occupations, or falls asleep if the
tysm have occurred during the night. Similar paroxysms recur
g each day and night; usually more frequent during the night
by day, occurring at intervals of an hour, or half an hour, or
few minutes. Their intensity and their number continue to
ase for two weeks or longer.

uring the spasmodic stage the patient is generally free from fever;
if complications are absent, comparatively little discomfort may
perienced during the intervals that are free from cough. Auscul-
n of the lungs indicates very little disturbance of respiration, only
hoarse râles being audible in the bronchi. Similar auscultation
g the paroxysm of cough discovers no vesicular murmurs or
ratory sounds excepting at the moment of inspiratory spasm.

severe cases of the disease blood may escape from the nose and
the mouth, and even from the ears, during the paroxysms.
ute vessels may rupture beneath the conjunctiva, or in the loose
ar tissue of the eyelids, causing subcutaneous or sub-conjunctival
rrhage. Violent paroxysms of sneezing may occur in addition
e cough. Urine and feces may also be expelled during the violent
nodic contractions of the abdominal muscles, and hernia may be
produced. Sometimes convulsions occur, or the patient may
ar depressed and disposed to heavy sleep during the intervals of
; a condition even more dangerous than that of convulsions.
t prostration may supervene, with loss of appetite, failure of
tion, and death from exhaustion.

age of decline and convalescence. If, however, no serious com-
tions disturb the course of the disease, after a period of two to six
s, or more, the convulsive stage shows signs of amelioration. The
xysms become less frequent, of shorter duration, and marked by
nishing severity. Little by little the whoop ceases to be audible,
the catarrhal symptoms remain most prominent. Expectoration
nes muco-purulent; the stomach becomes more retentive of its
nts; appetite, digestion, and nutrition improve, and the patient
nes his usual health after a period of variable duration. Often,
apparent recovery, paroxysms of spasm may be renewed, as the
equence of slight disturbances of digestion or of relapsing catarrhal
itions in the respiratory organs. Children of a nervous tempera-
may thus appear to be experiencing relapses of whooping-cough,

which, however, are not such, but are only manifestations of a nervous habit that has become partially engrafted upon the original constitution.

Complications. The most frequent complications are the various inflammations of the *respiratory organs*. These may be recognized by the ordinary symptoms of laryngitis, bronchitis, and the different forms of pneumonia. *Pleurisy* with effusion occasionally occurs. The air vesicles of the lungs may become ruptured during the paroxysm of the cough, producing *emphysema* of the whole body. The accident is generally fatal, but fortunately is of rare occurrence. A more common incident is *bronchial dilatation*. Ulceration and laceration about the *frenum* of the *tongue* are sometimes observed as a consequence of spasmodic protrusion of that organ against the lower incisor teeth. A *catarrhal condition* of the *stomach* and of the *intestines* is not uncommon. *Diarrhœa* may sometimes occur, but the bowels often remain constipated. Severe and obstinate *vomiting*, especially during the later stage of the disease, is not always the result of gastric disorder, but may be a symptom of *meningitis*. This is usually of the tubercular species, and is one of the manifestations of tuberculosis which not infrequently follow as sequelæ of whooping-cough. Other *infective diseases* often follow or precede whooping-cough. Occasionally *cerebral hemorrhage* is witnessed.

Diagnosis. During the catarrhal stage of the disease, whooping-cough can scarcely be distinguished from other catarrhal affections of the respiratory organs. But the first characteristic whoop will suffice to decide the diagnosis. Sometimes, however, that symptom may be absent for a time, but the spasmodic and suffocative character of the paroxysms, the tendency to vomiting, and the expectoration of viscid mucus, are sufficient to indicate the nature of the disease, especially if it prevail epidemically in the neighborhood. *Influenza* and the coryzal stage of *measles* sometimes resemble the later portion of the catarrhal stage of whooping-cough, but the progress of those diseases will soon remove all doubt. *Capillary bronchitis* occurring in rickety children is sometimes characterized by a spasmodic cough, but in such cases auscultation reveals the signs and symptoms of bronchitis, which are absent in uncomplicated whooping-cough. The character of the expectoration differs widely in the two diseases. Certain cases of *tuberculosis*, involving the bronchial glands and the lungs themselves, are sometimes accompanied by a spasmodic cough, with duskiness of the face, which may suggest the paroxysms of whooping-cough, but in all these cases the characteristic whoop is very imperfectly imitated.

Pathological Anatomy. The morbid changes that are discovered after death from whooping-cough are those that characterize the complications which have induced a fatal termination. Various discoverers have endeavored to trace a connection between the disease and certain changes involving the meninges of the brain, the medulla oblongata, the pneumogastric nerves, or the peri-bronchial glands; but there is no uniformity of concurrence between the lesions of these organs and the symptoms of the disease.

Etiology. Recently the attention of observers has been attracted

e presence of various bacteria in the bronchial mucus. These
ites have been isolated by cultivation, and have communicated to
ts and dogs a catarrhal disease of the respiratory passages, with
, and suffusion of the eyes. These experiments have led to the
that the active agent of the contagion is of bacterial origin.
e various atmospheric conditions that favor the development of
ary bronchial affections exercise but little influence over the occur-
e and propagation of whooping-cough. It, however, occurs more
uently in the spring months and in the autumn than during other
ons of the year. It attacks children most frequently, because
ts have generally experienced the disease in their childhood, and
thus protected against the disease. Females appear to be more
ject to it than males.

The disease is transmitted through the air, and by the medium of
thing or other objects that have been in contact with the patient.
e contagion is probably communicable from the beginning of the
tarrhal stage until a late period in the stage of decline.

PROGNOSIS. The uncomplicated disease usually terminates in re-
very. Different epidemics, however, vary greatly in the severity
d in the fatality of the disease, by reason of the complications which
aracterize their course. Early infancy and childhood predispose to a
tal termination. According to English statistics no disease is more
tal among children in the first year of life. Sixty-eight per cent. of
deaths caused by it occur before the end of the second year. After
e fifth year the mortality is only six per cent.

TREATMENT. There is no specific remedy for whooping-cough. The
dications for treatment are: 1. To relieve the catarrhal symptoms.
To lessen the paroxysmal severity of the cough. 3. To overcome
e complications that may arise during the course of the disease.

Catarrhal stage. During this period the cough may be treated like
y simple bronchial catarrh. Unfortunately, however, it does not
ld to such treatment, and this fact may suggest a suspicion regarding
real nature of the disease. At first a simple mixture containing
aphorated tincture of opium, syrup of ipecac, solution of the acetate
monium, and glycerin, may be given as required. With the appear-
e of a spasmodic tendency in the paroxysms of cough, belladonna in
opriate doses may be added to the mixture.

Spasmodic stage. Depressing agents should be rejected during this
e. By the older physicians stimulating emetics, such as sulphate
opper, Turpeth mineral, small doses of ipecac, and powdered alum
e considered of great value in cases that were characterized by suf-
tive symptoms. Opium must be used with great caution, especially
ne treatment of very young children. Belladonna and hyoscyamus
the most useful anti-spasmodics of vegetable origin. These prepa-
ons may be given in frequent doses, until moderate physiological
ptoms of their effect are produced. Brown-Séquard expresses the
ef that by the watchful administration of atropine for three days,
quantities sufficient to produce a moderate efflorescence upon the
ace of the skin, the paroxysmal stage of whooping-cough may be
uptly terminated. Other experimenters are less sanguine. Of other

anti-spasmodic remedies the most valuable are hydrocyanic acid, chloral, urethan, compound spirits of ether, and the sulphur, caffeine, cochineal, carbonate of iron, ergot, nitrate of nitric acid, alcohol, and innumerable other remedies have been and lauded by many generations of physicians. Antipyrine, phenacetine, acetanilide, and exalgine are now under trial. Various methods of treatment by inhalation have been advocated, from the fumes of house lime to the latest methods of contaminating the air of the with preparations of carbolic and cresylic acids. Oil of eucalyptus not without some slight value. It may be rubbed upon the body of the patient, and a sponge saturated with the liquid may be placed under the pillow at night. Vaccination of unvaccinated infants during the period of decline sometimes appears to hasten convalescence; generally it produces no marked influence upon the course of the disease. Great prostration resulting from excessive severity and unusual prolongation of the disease may be favorably combated by a change of residence, even within the limits of the same town or city.

The recognition of the infective character of whooping-cough has been followed by attempts to treat the disease by antiseptic methods. In accordance with this view, it has been recommended to syringe the nostrils and to mop the pharynx with weak solutions of salicylic acid or boric acid, or with a four per cent. solution of cocaine. Corrosive sublimate has also been employed for the same purpose, but this is too dangerous a drug for such a purpose.

The strength of the patient must be carefully sustained by an abundant and digestible diet, in which milk and eggs, and the various *prepared* foods that are furnished for young children, should occupy the principal place. Warm clothing and uniform temperature, with sufficient ventilation, must be provided. During convalescence daily exercise in the open air, in favorable weather, will exercise a salutary influence.

Complications must be treated as they occur.

CHAPTER XXII.

BREAK-BONE FEVER—DENGUE.

DENGUE is an epidemic, infective fever characterized by cutaneous eruptions, intense articular and muscular pain, intermission, and relapse, terminating in convalescence at the expiration of about one week. It is a disease that prevails epidemically in tropical countries, rarely passing the thirtieth degree of north latitude, yet sometimes prevailing quite extensively along the shores of the Mediterranean.

ETIOLOGY. *Dengue* prevails among all classes of the population, without regard to age or sex. Locality exercises less influence upon

e prevalence of the disease than the temperature of the atmosphere. elevated regions of the tropics, for this reason, it prevails less com- ly than upon heated plains near the level of the sea. It is un- edly dependent upon a contagion that is transmissible from person son. Hence the occurrence of the disease may be traced along ates of travel and navigation in and from the lands of the tropics. he contagion of influenza, the contagion of dengue appears to be ely volatile, so that it is diffused with the greatest rapidity hout the entire community, prostrating almost simultaneously the ants in the centres of population.

PTOMS. The course of dengue is characterized by four distinct = 1. The period of invasion and transient eruption. 2. The of intermission. 3. Relapse and characteristic eruption. 4. e and convalescence.

asion. After exposure there is a period of *incubation*, continuing welve to twenty-four hours, during which there is sometimes a g of general disorder; but usually the invasion of the disease is t. The patient is attacked by severe pain in the joints, muscles, nerves, accompanied by a fever that rapidly rises to 102° F., or higher. The head aches; the whole body is racked with pain; face swells, and becomes red; the whole surface of the body burns h heat. The tongue is covered with a white coat, and is red at the p and edges; there is thirst, nausea, sometimes vomiting, constipa- ion, or occasional diarrhœa. The urine is generally scanty and high colored, but sometimes it is abundant and limpid. In the majority of patients the entire surface of the body and the face are covered by a diffuse scarlet rash, called by the English physicians in India *the initial rash*. It sometimes occurs in separate patches, resembling the eruption of urticaria. Its duration is usually about five or six hours, hardly ever continuing so long as twenty-four hours. It then disappears without desquamation.

Period of intermission or remission. At the end of about forty- eight hours, or, in rare cases, after a period of five or six days, the fever subsides. The painful phenomena of the disease also cease, and often critical perspiration, diarrhœa, or epistaxis may be observed. The ver in many instances disappears entirely; but in others the tempera- re remains above the normal point, and the patient continues in a te of considerable prostration. This period of intermission or remis- n continues from one to three days.

Period of relapse. This phase of the disease is characterized by the cial eruption called by the Indian physicians the *terminal rash*. The ption resembles the eruption of measles, scarlet fever, and urticaria. Consists of minute papules that are sometimes elevated above the level the skin, accompanied by intense itching. Among these papules a mber of vesicles, pustules, or bullæ are sometimes visible. It com- nces usually upon the hands and feet, which become slightly tumefied, l extends gradually over the whole body. It continues from one to ee days. It may be accompanied by fever, though frequently that mptom is absent. Sometimes there is a renewal of pain in the ints.

Period of decline. As the eruption disappears the febrile symptoms also subside, and desquamation follows, as in scarlet fever or in measles. The exfoliation of the epidermis occurs in the form of minute, dust-like scales, as in measles, or it may peel off in considerable flakes and scales as in scarlet fever. This process is frequently accompanied by considerable itching. Convalescence is liable to be considerably prolonged, and is often marked by persistent pains in the joints; cutaneous abscesses and furuncles sometimes make their appearance. These sequelæ of the disease not unfrequently defer indefinitely the period of complete recovery. Relapses of the fever are also not unfrequent.

PROGNOSIS. Dengue is scarcely ever fatal. The disease is to be dreaded, not for its mortality, but for its painful character, and for the prolonged valetudinarianism that follows in its wake.

DIAGNOSIS. The fever of dengue resembles in many particulars the other infective fevers that are encountered in warm climates. It must be distinguished from mild forms of *yellow fever* by its relapse, and by the eruptions which are absent in yellow fever. The same absence of eruption marks the fevers of *malarial regions*. *Relapsing fever* may be distinguished from dengue by the absence of eruption and by the discovery of *spirilla* in the blood of the patient. From *influenza*, dengue may be distinguished by the intermission of the fever, and by the characteristic eruptions. From *scarlet fever*, dengue may be distinguished by the course and remission of the fever, by the absence of sore-throat, and by the concurrence of articular pains with the period of eruption, whereas the pains of scarlatinal rheumatism succeed the period of eruption in scarlet fever. *Measles* sometimes resembles dengue, especially when that disease is accompanied by redness of the conjunctivæ and suffusion of the eyes; but the absence of bronchitis, and the course of the disease are sufficient to distinguish dengue from measles. *Smallpox* could only be suspected during the invasion of dengue, but the difference in the character of the eruptions soon suffices to distinguish the two diseases. In like manner only a superficial examination could lead to confusion between dengue and *erysipelas*, *erythema*, or *urticaria*. *Articular rheumatism* might be mistaken for dengue during the period of fever and articular pain; but the course of the fever, and the concurrent eruption suffice to distinguish dengue from acute rheumatism; and from the pain of *chronic rheumatism*, the articular pains that occur during the convalescence after dengue may be distinguished by reference to the character of the initial fever and eruption.

TREATMENT. At the commencement of the fever a mercurial cathartic and an efficient emetic are said to afford great relief to the headache and pain that so distressingly characterize the onset of the disease. After this evacuation the patient may be treated during the febrile period with antipyrine or phenacetine until the intermission takes place. During that interval, quinine has been used in large doses with a view to the prevention of relapse. The utility of this remedy is in proportion to the concurrence of malaria with the contagion of dengue. Cool baths, and ice-caps applied to the head are useful if the fever is excessive and the headache severe. Hypodermic injections of morphine and atropine form the most efficient means for

relief of pain. Chloroform liniment may be applied to the painful nts. During the period of convalescence, iron, quinine, nux vomica, d other vegetable bitters will be found useful. Change of climate is e of the most efficient means of restoration in cases that are char-terized by chronic debility.

CHAPTER XXIII.

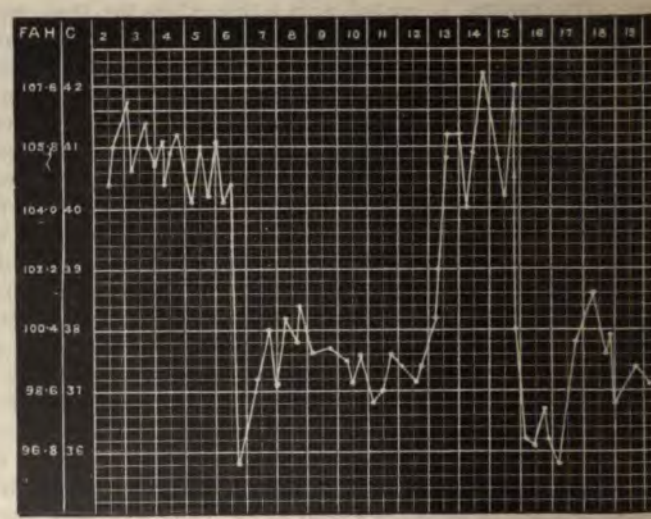
RELAPSING FEVER—FEBRIS RECURRENS.

Under conditions of starvation and misery similar to those which avor the explosion of typhus fever, a kindred form of epidemic and nfective fever has been observed, particularly in Great Britain and in he north of Europe, commencing with headache, chills, nausea, and omiting. The temperature and the pulse soon rise and increase in requency. The tongue is coated with a thin white fur that may dry p and become brown as the disease progresses. There is no diarrhœa or any characteristic eruption upon the skin. The liver and the pleen are usually enlarged, and jaundice may appear. Notwithstanding onsiderable nervous excitement and prostration, the mind usually re-ains clear. After the expiration of six or seven days, there is copious erspiration and rapid fall of temperature to the normal or subnormal oint. During the second week, the patient remains free from fever; ut, about the fourteenth day, a second paroxysm is developed with a turn of all the original symptoms, At the end of five or six days a cond intermission is manifested which may pass into convalescence, or y be succeeded by subsequent paroxysms similar to those that have eviously appeared. Unlike certain other contagious fevers, its occur-ce does not protect against subsequent attacks, so that the same ients may experience the fever more than once during the same demic.

Symptoms and Description of the Disease. The length of the od of *incubation* after exposure to infection, is exceedingly variable. fever sometimes commences within a few hours after exposure; in r instances no definite time of infection can be observed; in others only after the expiration of one or two weeks that the fever appears. Onset is usually quite sudden, commencing like an intermittent fever a violent headache and a severe chill. Dizziness and nervous tration soon overcome the patient. The duration of the initial chill uite variable. It may continue for a few minutes only, or for a ber of hours. It is followed by great elevation of temperature, mpanied by intense headache and pain in the loins. (Fig. 84.) The perature rises to 105°, 106°, or even 107° F. Sometimes the tem-ature rises higher each successive day, with slight morning remis-ns, closely simulating the invasion of typhoid fever. During this gressive increase, all the symptoms of the disease are progressively

intensified. The pulse rises above 100, and may even reach 150 or 160 beats. Respiration is accelerated, frequently reaching 40 or 50 per minute, although nothing more serious than a slight bronchial catarrh may involve the respiratory organs. During the daily oscillations of the fever, a little perspiration may appear; occasionally there is a sensation of slight chilliness. After three or four days, the tongue becomes dry and brown; thirst is excessive; nausea and vomiting are frequently observed. The evacuations of the stomach are slimy and bilious, and may occasionally contain altered blood, presenting the appearance of coffee-ground sediment. The bowels are constipated; jaundice makes its appearance; the urine is highly charged with biliary pigments; but the fecal discharges retain their bilious color, showing that the common bile-duct is not completely closed. The liver and the spleen are considerably enlarged and painful on pressure, giving occasion to uneasiness and suffering in the epigastric and hypochondriac regions. The patient continues restless and sleepless during the febrile paroxysm, though delirium is usually absent.

FIG. 84.



Temperature in relapsing fever. (WUNDERLICH.)

In this condition the patient remains for about one week. The paroxysm then terminates abruptly by crisis. In a few hours the pulse and the temperature resume their normal course; pain ceases; the skin becomes moist and copious perspiration may take place. Sometimes there is diarrhœa, or a copious discharge of urine, or even some form of hemorrhagic incident. With the exception of a certain degree of debility, the patient appears to be quite recovered. About fourteen days after the original attack a second paroxysm commences. Its symptoms and its course are like those of the first paroxysm, but its duration is not as great. After three or four days a second inter-

mission takes place, which, like the first, may be followed by a third paroxysm. Sometimes there may be four or five, or even a larger number of successive paroxysms. Each paroxysm is ordinarily of shorter duration than the preceding, and the length of each intermission corresponds very closely with the duration of the previous paroxysm.

It has been said that relapsing fever presents no characteristic *eruption* upon the skin, but this does not negative the fact that during its course various eruptions, such as sudamina and the vesicles of herpes, may appear as the paroxysms approach their culmination. The skin frequently exhibits an increased vascularity; there is, in about one-quarter of the cases, an icteric discoloration of the integument. Sometimes petechial spots are displayed in cases that are characterized by a hemorrhage from the mucous surfaces.

The quantity of *urine* is not usually diminished. It is very highly colored, and during the febrile paroxysm it contains a large increase of urea. During the intermissions the urine diminishes in quantity, and its nitrogenous constituents are decreased. Each successive paroxysm of the fever is marked by a renewal of polyuria and an increased elimination of nitrogen. This increased discharge of urine, coincident with each febrile paroxysm, is one of the most characteristic symptoms of relapsing fever.

Symptoms connected with the *nervous system* present nothing characteristic. There is less nervous exhaustion than in typhus fever; slight delirium, insomnia, occasional convulsions, and sometimes a tendency to collapse at the crisis of the fever, are the most prominent features. Articular pains are not infrequent, but these are not associated with swelling or redness such as are observed in rheumatism.

Complications. *Bronchial catarrh* is not infrequent. *Pneumonia* occasionally observed. *Hemorrhages* from the different mucous membranes of the body sometimes occur near, or at, the close of a paroxysm. *Transitory paralysis* has been observed in the extremities during or after a febrile paroxysm. An *inflammation of the retina* sometimes follows the disease, usually after an interval of several weeks or months. It is ordinarily limited to one eye, particularly the right one, and rarely produces complete destruction of vision. *Diarrhœa* sometimes occurs as a critical discharge. During the remission of the fever it may be accompanied by *intestinal hemorrhage*. *Erysipelas* is often observed during convalesence, and it sometimes results fatally. *Dropsical symptoms* frequently follow the fever as a consequence of weakness of the heart and impoverishment of the blood.

Diagnosis. Relapsing fever must be distinguished: 1. From *bilious fever*, by the rapid rise of temperature, exceeding what is observed in acute gastro-enteric catarrh. 2. From *smallpox* it may be distinguished by the absence of eruption on the third day. 3. From *typhus fever*, with which relapsing fever was long confounded, it may be distinguished by the more abrupt and violent onset; by the absence of the stupor and early delirium which are common in typhus fever; and also by the absence of eruptions and by the presence of jaundice. It may also be distinguished from typhus fever by the critical intermission of the fever,

and by its relapsing course. It is only when relapsing fever becomes complicated with unusual cerebral disturbances and a typhoid condition, that it can be mistaken for typhus fever. 4. From *typhoid fever* relapsing fever may be distinguished by its abrupt commencement; by the rapid elevation of temperature; by the absence of eruption and diarrhœa; by the presence of jaundice; and by the critical intermission. The abdominal symptoms of typhoid fever, such as tympanites, diarrhœa, and swelling or ulceration of Peyer's patches, are absent in relapsing fever. 5. From *malarial fevers* relapsing fever may be distinguished by the absence of remissions and by the greater length of the paroxysms and intermissions. Relapsing fever may also occur in regions where malarial fevers are unknown, and, unlike those fevers, it is communicable from person to person. 6. *Yellow fever* differs from relapsing fever by the fact that it occurs for the most part in tropical climates, or as an imported exotic into temperate regions. It is always marked by jaundice of a deeper hue than is apparent in relapsing fever. The so-called black vomit, that is of such frequent occurrence in yellow fever, is rarely observed in relapsing fever. Yellow fever, moreover, presents but one paroxysm, and is far more fatal than relapsing fever.

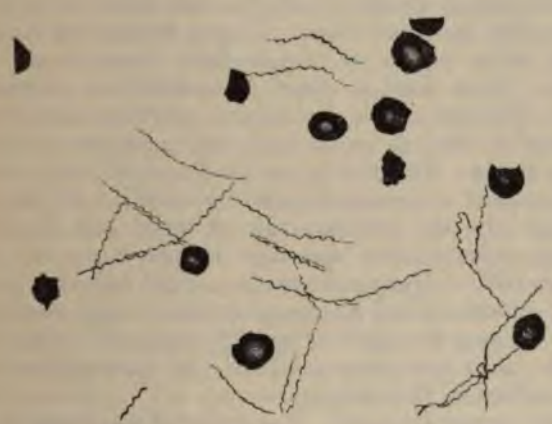
PROGNOSIS. The duration of relapsing fever rarely exceeds three weeks. Its first paroxysm is the most dangerous. The mortality of the disease is greater among males than among females, among aged people than among children and young people. Below thirty years of age the mortality scarcely exceeds two per cent.; above that age the mortality is higher. In Great Britain the average mortality is not far from four per cent.; but among the famine-stricken peasants of India it may reach twenty per cent. Hemorrhagic and typhoid forms of the disease exhibit a mortality of sixty per cent. or more.

PATHOLOGICAL ANATOMY. There are no characteristic changes in the majority of uncomplicated cases. *Emaciation* is considerable. There may be slight *injection* of the mucous lining of the *stomach* and *intestines*, but no marked alteration of Peyer's patches. The *liver* is enlarged, but nothing can be found to explain the jaundice that exists in about one-fourth of the cases. The *spleen* is greatly enlarged, and may occasionally be ruptured, with an effusion of blood into the peritoneum. The *kidneys* frequently present the characteristics of slight catarrhal nephritis; and evidences of hemorrhage, or even of suppuration, may be occasionally observed. The *blood* is usually liquid and dark in color, and may be loosely clotted in the heart and large veins. With the exception of slight *catarrhal bronchitis* no other characteristic changes have been observed.

ETIOLOGY. The connection of relapsing fever with poverty, famine, and social misery has already been mentioned. Age, sex, nationality, occupation, and climatic influences exercise little influence over the prevalence of the disease. It is dependent upon a communicable poison that is transmissible from person to person. This poison owes its activity to the presence of a microörganism that was discovered by Obermeier, in 1873. This microscopical bacterium belongs to the class *spiro-bacteria*, and is named *spirochæte Obermeieri*. This spiro-bacte-

, or spirillum (Fig. 85), is a delicate, colorless, spiral filament, five-hundredth to one-fifteen-hundredth of an inch in length. The sites are only found in the blood, where they make their appearance ng the paroxysms of the fever, disappearing during the intermis-, and reappearing with the relapse. They have been cultivated ide of the body, and the fever has been communicated to healthy sons by inoculation with infected blood.

Fig. 85.



Spirillum from the blood in a case of relapsing fever. × 700. (Koch.)

Treatment. At the outset of the fever the bowels should be gently cuated with a mercurial cathartic, and, as the temperature rises, baths and cooling lotions may be employed as frequently as may consistent with the comfort of the patient. Antipyrine or phenace- may be administered when the temperature is high, if perspiration not already excessive. Vomiting may be controlled by the use of nd by the administration of small doses (one-thirtieth of a grain) morphia every half-hour. With this may be given drop doses of e hydrocyanic acid. Severe muscular pain, restlessness, or insom- may be relieved by hypodermic injections of morphia and atropia. etics are seldom needed, since the urine is usually increased in tity by the fever itself. Light diet and an abundance of cold r may be freely allowed. Much relief at the time of crisis may be ined by frequently wiping away the perspiration which often satu- the clothing. A tendency to collapse must be opposed by the ious use of stimulants, and by the administration of camphor, cap- n, nux vomica, and ammonia. During the intermission of the fever patient should be prevented from active exercise or exposure of any . No remedies have been found that can prevent the relapse, or antagonize the contagion of the fever. After the establishment of alescence the recovery of the patient may be aided by tonic doses ron, quinine, arsenic, strychnia, or the mineral acids. Sequelæ, as sometimes affect the eyes, must be treated as they occur.

CHAPTER XXIV.

CHOLERA—CHOLERA ASIATICA.

CHOLERA is an acute, epidemic, infective disease that is characterized by violent vomiting, purging, collapse, and death in about fifty per cent. of the fully developed cases. It is a disease that is permanently endemic in India, where its ravages have been recorded from time immemorial. From time to time its tendency to diffusion becomes aggravated. Emerging from its Asiatic source it extends along the lines of travel in every direction, becoming pandemic and invading all parts of the world. The first great epidemic of which we have any certain information was initiated in the year 1817. Slowly progressing in accordance with the moderate rate of travel and the difficulties of international communication that then existed, it reached the borders of Europe in 1829. During the seven or eight following years it traversed the countries of the European continent and America. Since that date the disease has again invaded Europe and America a number of times, though it has never exhibited the same pandemic virulence that characterized its first invasion.

SYMPTOMS OF THE DISEASE. The period of *incubation* is of variable duration. According to certain observers it may be as brief as twelve hours, according to others it may continue for three or four weeks. It is generally less than a week. The course of the disease may be studied in three successive stages.

1. *The stage of invasion.* During this period the patient complains of general ill-feeling, with uneasiness in the epigastric region, lassitude, and nervous prostration. There is loss of appetite, rumbling in the bowels, and slight diarrhœa, which usually begins in the night with copious watery, yellowish stools of a bilious character, sometimes slightly colored with blood. They are discharged without pain, very much like the evacuation of an intestinal injection. There is no fever, the tongue is broad and covered with a thin white fur. As this diarrhœa continues the patient may become constrained to remain in bed, but there is nothing alarming in the symptoms, and often they may subside, and apparent convalescence may be established. But after a few hours, or three or four days, the full development of cholera takes place. This transition most frequently occurs during the night. The bowels are most copiously evacuated, and the stools assume the characteristic appearance of *rice-water discharges*. There is intense thirst, nausea, and profuse vomiting, sometimes accompanied by extreme pain. The tongue is large, moist, and covered with white fur. The abdomen collapses, and pressure with the hand causes gurgling throughout the intestinal tract. The discharge of urine ceases. The patient manifests signs of intense prostration. The pulse is small and frequent, the extremities grow cold, the whole body appears wonderfully emaciated, the

ce becomes thin and anxious. Violent cramps commence in the lves of the legs, and extend into other muscles of the body, and the gid stage of the disease is developed. The stage of invasion may ntinue from half an hour to one or two days, and in favorable cases ay terminate in convalescence without the appearance of the successive ages of the fully developed disease.

2. *The algid stage.* In certain cases this stage of the disease appears almost immediately, but it is usually preceded by well-marked ymptoms of the period of invasion, during which the patient sinks gradually into the second degree of the disease. Vomiting and purging become less copious and frequent, or sometimes cease altogether. The head aches, and there is a sensation of humming in the ears. The voice becomes hoarse, feeble, and finally reduced to a mere whisper. An unutterable feeling of agony is experienced in the epigastric region. The muscles are the seat of painful cramps, there is continual nausea and effort to vomit. The eyes sink in their sockets, and are surrounded by broad, dark rings that indicate exhaustion. The nose becomes pointed and cold, the cheeks sink between the jaws, the whole surface of the body becomes cyanosed. Patches of ecchymosis appear upon the surface of the body. Points of incipient gangrene sometimes appear over bony prominences that are subjected to pressure. The extremities become icy cold. The fingers shrivel like those of a corpse; even the breath seems cold, though the patient complains piteously of burning heat within the body. The conjunctiva dries like that of a patient in an advanced stage of typhoid fever. The movements of the heart become progressively weaker. The pulse disappears, respiration is frequent, shallow, and unsatisfactory. The muscles become flaccid, the skin loses its elasticity, remaining in folds like wet chamois-skin when pinched between the thumb and finger. The patient may be either restless, tossing about and striving to rise from his bed, or he may manifest complete apathy and indifference to his condition. The senses fail, and the patient dies in a state of terminal coma. The duration of the algid stage may vary from a few hours to two or three days. Recovery takes place in only twenty-five per cent. of the cases.

3. *The stage of reaction and convalescence.* The process of reaction may be either regular or irregular, rapid or slow, simple or complicated. In favorable cases convalescence proceeds regularly by the gradual disappearance of morbid symptoms, and the return of circulation, respiration, and the production of heat, to their normal standard. Vomiting ceases, the natural function of the bowels returns, the kidneys again become active, appetite reappears, and often in less than twenty-four hours the patient is completely convalescent.

But in many instances the return to health is interrupted by imperfect efforts toward the restoration of normal function throughout the body, followed by relapses of greater or less severity. The patient may become delirious, and a typhoid condition may be established. Though the symptoms of algidity have disappeared, there is intense prostration. The circulation is exceedingly feeble, the body remains cool, the urine is scanty, and gastro-intestinal irritation persists for a considerable period of time. Convalescence is very slowly established.

In certain other cases the period of reaction is marked by a considerable febrile movement. All the phenomena of fever are present. Vomiting generally ceases, but there is often a persistent diarrhœa. The urine may be suppressed, or, if it is secreted, it may be retained in the bladder. After eight or ten days the patient becomes comatose and dies.

Varieties of the disease. The *prodromic diarrhœa* that usher in the violent cases of cholera must be considered a mild form of the disease. It is excited by the morbific agent, and may suffice to eliminate that agent through the alimentary evacuations, without further disturbance of the system. The opposite degree of infection is exhibited in those cases in which the patient is smitten down, apparently in perfect health, and dies in a few minutes, perhaps without evacuation from the stomach or the bowels, which, after death, are found distended with the characteristic rice-water stools. In certain instances the *heart* appears to experience the principal effects of infection, and death occurs from complete cardiac exhaustion, preceded by disappearance of the pulse and paleness of the skin, without muscular spasms or gastro-intestinal discharges.

In other cases, *vomiting* and *purging* constitute the most formidable symptoms. The surface of the body becomes cold and pale. There is rapid emaciation, and death occurs quietly in collapse.

Again, *muscular spasm*, involving various groups of muscles throughout the body, may constitute the most characteristic symptom. Respiration is greatly hindered, and there is profuse cyanosis caused by spasmodic contraction of the muscular coats of the small arteries. Vomiting and purging are occasionally entirely absent. The patient is rapidly asphyxiated, and death soon follows.

Various *cutaneous eruptions* have been sometimes observed during the period of reaction. *Pneumonia*, *bronchitis*, *laryngeal diphtheria*, *gangrene of the lungs*, *meningitis*, *parotitis*, *boils*, and *cutaneous abscesses*, have also been observed as complications of cholera during the period of reaction. In certain cases *gastro-intestinal catarrh* is persistent; *anæmia*, with its accompanying tendency to *œdema*, may become developed. A disposition to *muscular cramps*, *local paralyses* and *muscular atrophy*, *intellectual enfeeblement* and various forms of *insanity* may be sometimes observed; but, fortunately, they generally terminate in recovery. *Purulent inflammations* of the *conjunctiva*, *nasal mucous membranes*, and *auditory passages*, are not uncommon. Aural inflammation with subsequent deafness occurs as frequently after cholera as after typhoid fever.

Pathological Anatomy.—The pathological appearances that are observed after death vary according to the stage of the disease in which the fatal termination occurred. The morbid changes that characterize the algid stage are *hyperæmia* of the brain and spinal cord, *hyperæmia* and *desquamation* of epithelium from the mucous coat of the small intestine, and a similar desquamation of epithelium in the *tubuli uriniferi*. If life be sufficiently prolonged, there are visible patches of *ecchymosis* in the serous membranes of the body, the pericardium and endocardium, pleura, peritoneum, and meninges. There is an ev

dent *desquamation* of *epithelial cells* from all the mucous and serous surfaces of the body, together with a copious discharge of *serous liquid from the* capillary vessels. This fluid, rendered turbid by the admixture of desquamated epithelium, constitutes the rice-water discharges *from the* alimentary canal; mixed with the desquamated endothelial cells, it constitutes the viscid exudation that is often found upon the serous surfaces of the body. The follicles of the small intestine are swelled, and the intestinal wall is infiltrated with small, round cells.

If death occur during the period of reaction, a great variety of pathological changes may be discovered, according to the severity of the symptoms and the character of the complications that have been predominant. The lower part of the *small intsetine* is sometimes *ulcerated*, and the *large intestine* may present the appearances of *dysenteric inflammation*, if life has been considerably prolonged.

After death there is sometimes a notable rise of temperature throughout the tissues of the body, owing to the fact that their death is not simultaneous. Spontaneous muscular contractions are sometimes observed for several hours after respiration and circulation have ceased. The limbs may be thus displaced as if the subject were alive.

DIAGNOSIS. *Cholera nostras* closely resembles *Asiatic cholera* in everything except its fatality, which is very slight. It is a disease that occurs in all countries during hot weather, and should not be mistaken for the Asiatic pestilence, unless an exception be made during the epidemic prevalence of the foreign disease.

Certain cases of *acute poisoning* present symptoms that somewhat resemble the phenomena of cholera; but with due attention to the symptoms as they occur, the infective disease may be excluded, even though it be prevailing epidemically at the time. In case of doubt, a careful microscopical examination of the rice-water discharges will decide the question by determining the presence or absence of the spirilla that characterize the contagion of cholera.

PROGNOSIS. The mortality in cases of fully developed cholera varies little from fifty per cent. The symptoms that indicate the probability of a fatal result are violent cramps extending to the upper extremities, profound collapse, relaxation of the sphincters, retention of the stools by reason of intestinal paralysis, a frequent and feeble pulse, rapid and irregular respiration, great depression of temperature, continued suppression of urine, especially if associated with a tendency to somnolence. Delirium, convulsion, and coma are all symptoms of impending death.

The manifestation, during the period of reaction, of a tendency to relapse into the algid stage is an alarming sign. Pneumonia, diffuse suppuration, and gangrene are indications of the worst possible character.

ETIOLOGY. Every condition of life that is antagonistic to health may be said to favor the invasion of cholera. But the active agent by which the disease is produced and transmitted is a microörganism that was discovered in the stools of cholera by Professor Koch, of Berlin, who studied the disease in Egypt during the year 1884, and there

made this capital discovery. The bacterium discovered by slightly curved in shape, somewhat resembling a comma; name *comma bacillus* that has been employed in describing the par length is from one-fifth to one-th diameter of a red blood-corpuscle end to end the comma bacilli resemb and they are now considered to b of that genus, *spirillum choleræ asi* so-called comma bacilli being merel of the developed form. These par in the heated waters of stagnant p Delta of the Ganges. Taken into t stomach, they are generally destro acid gastric juice and by the bile encounter in the small intestine. secretions of the alimentary canal b by indigestion, the parasitic spiri veloped with great rapidity in the and the phenomena of cholera appear. The parasites are fou the contents of the alimentary canal. They do not penetrate nor find their way into the general circulation. It is there sary to suppose that they produce in the intestines a poisonous that is absorbed and conveyed into the circulation, and th nomena of the disease are the result of its action upon the n other tissues of the body. This substance, which belongs t of *toxalbumins*, has been actually isolated, and its poisonou have been demonstrated by experiment upon the lower anim apparently the only active agent by which poisonous effect duced in cholera, and it is probable that it must accumulate t extent in the tissues before any symptoms can occur.

Fig. 86.



Spirillum of cholera. (Hallopeau.)

For this reason the disease is not communicated by perso or through the air. The intestinal dejections, charged wi must find their way into the drinking-water or food befor reach and infect other persons. In this way it is possible stand the propagation of the disease through contamination o water by direct mixture with cholera stools, or by thei through the soil into such sources of supply as are accessible population. Not only in stagnant water, but in moist earth articles of clothing that have been dampened by the rice charges, can the spirilla of cholera multiply themselves. Soil may thus become the vehicle of transmission between a chol and other persons who have occasion to handle such clothing. lack of cleanliness food and drink may become contaminate lethal microörganism may find its way into a stomach that sufficiently disordered to furnish a favorable locality for t development of the parasite. Thus it happens that, though municated by direct personal contact like the contagion o and diphtheria, cholera is diffused by the agency of ma Thus it happens that the epidemic progress of the disease

nes of travel and commerce, and is spread by the transfer of human beings from place to place. Since the spirillum of cholera can only flourish in very warm water, it becomes endemic in very warm climates only. Since, moreover, its vitality is very easily affected by a multitude of chemical agents, it can only prevail as an epidemic where the conditions of soil and water and climate are such as permit its multiplication. Hence, in northern countries it usually disappears during the winter months, or is only propagated under exceptional conditions of warmth and moisture in the dwellings of the inhabitants. It apparently finds no permanent establishment outside of India, in consequence of peculiarities of soil and water that interfere with its indefinite propagation.

TREATMENT. The much-debated subject of public protection against cholera through the agency of quarantine, cannot be fully considered within the limits of this volume. It is sufficient to mention the importance of early information concerning the existence of imported cases of the disease in a previously healthy community. As in typhus fever and in yellow fever, the sick should be separated from the well; the stools should be thoroughly disinfected with a five per cent. solution of carbolic acid, and everything else that has been contaminated by the discharges of the patient should be treated in the same manner. Thorough cleansing of the infected habitation and its contents will speedily eradicate the disease, which tends to become endemic in large and ill-kept houses that are inhabited by the poor and negligent classes of the population. During the prevalence of cholera great caution should be observed in all matters pertaining to diet and digestion. Drinking-water should be filtered and boiled; milk and other liquids that are liable to contamination should be treated in the same way. Thorough cooking of vegetables will also serve to protect against infection through their intervention. Every error of digestion should receive immediate treatment, since it is through a morbid condition of the gastro-intestinal mucous membrane that the infective parasite finds its opportunity for multiplication within the alimentary canal. Undue fatigue and mental agitation of every form should be avoided, since by these means the sum of bodily resistance to infection is diminished.

The *prophylactic treatment* of cholera has received considerable attention since the brilliant results of Pasteur in the treatment of hydrophobia have attracted the attention of investigators. Hypodermic injection of an attenuated virus as a means of prophylaxis has been employed in Spain, but the method was imperfect, and the results were of a nature that did not admit of scientific valuation. Recent experiments in Pasteur's Institute have indicated the possibility of successful treatment by the prophylactic method, but it has not yet been subjected to the test of actual experiment upon man.

It being a fact that the parasitic agent of the contagion of cholera exists and multiplies in the intestinal canal, whence its products are diffused throughout the body, it follows that the indications for medical treatment are: 1. The destruction of the parasitic growth. 2. The early evacuation of their products from the body. 3. The antagonism of such products through the administration of some equally diffusible

substance that will itself be harmless to the tissues. Guided by th considerations the great value of calomel in the prodromal diarrh and through the early portion of the invasive stage of the disease explained. It is a matter of common observation that the administ tion of ten grains of calomel, followed by a gentle laxative like ca oil, and succeeded by a few doses of bismuth and opium, is sufficien arrest the attack of diarrhœa which otherwise would culminate cholera. With the same object in view, naphthaline has been rec mended in doses of five grains every two, three, or four hours. Si the cholera spirillum cannot survive in an acid medium, the emp ment of mineral acids as therapeutical agents has been widely rec mended, especially during the period of indigestion and diarrhœa precedes the explosion of cholera. For this purpose, after evacua of the bowels, the patient may take the following prescription:

℞.—Acid. hydrochl. dilut. ℥j
Tr. opii deod. ℥j
Aquæ q. s. ad ℥vj.—M.

S.—Take a teaspoonful in a wineglass of water every hour until the p begin to contract. Then continue at longer intervals.

With a view to the destruction of the parasites in the intestine, tani has recently recommended the use of large injections of ta acid, dissolved in water at the temperature of the body. Two or t quarts of warm water, containing from thirty to ninety grains of ta acid, and from five to fifteen drops of tincture of opium, in each q should be thrown into the bowels from three to six times in the c of twenty-four hours. By this means the accessible portions of intestinal tract are cleansed and disinfected. With the same obje view large doses of salol have been recommended for administratio the mouth and by injection into the bowels. During the sta vomiting and rice-water discharges, the patient may be permitte swallow small pieces of ice, and may be given the fiftieth of a gra morphine every fifteen or twenty minutes until the pupils begi contract. Mild attacks of the disease may be arrested with ordi preparations of opium and astringents:

℞.—Pulv. opii gr. iv.
Bismuth salicylat. ℥j.—M.

Div. in chart. no. xii.
S.—Take one powder every hour.

Or,

℞.—Tr. opii deod. ℥j
Tr. cinchon. co. ℥x.—M

S.—Take a teaspoonful in ice-water every hour until the pupils begi contract.

Attempts have been made to repair the immense loss of liquid o sioned by vomiting and purging, and the consequent thickening of blood, by intra-venous injections of a weak saline solution, but results have not been encouraging. A better effect has been produ by hypodermic injection into the loose subcutaneous tissues below clavicles, or between the ribs and the iliac bones, of a tepid solutio

sodium chloride and sodium carbonate in sterilized water. The strength of the solution should be twenty grains of sodium carbonate and thirty grains of sodium chloride in a pint of water. Of this, at least a quart may be gradually injected, and, even in the stage of collapse, its use is often followed by rapid improvement, which sometimes results in recovery. During the algid stage opiates should no longer be administered, since they are not absorbed, and their accumulation in the stomach may become a source of danger should reaction take place. A preferable stimulant is found in a ten per cent. solution of camphor in ether, of which ten or fifteen drops may be given in ice-water every half or quarter of an hour. Ten drops of the same solution, or of ether alone, form a powerful cardiac stimulant when hypodermically injected. A one per cent. aqueous solution of alcohol, with three-fourths of one per cent. of chloride of sodium, may also be injected hypodermically every few minutes, in quantities of two ounces at a time, until eight or ten quarts have been thus introduced beneath the skin. Hydropathic treatment, with massage and other similar manipulations, have been recommended with a view to equalization of the circulation and the promotion of perspiration. During the stage of reaction the function of the kidneys should be stimulated by the use of warm baths, with dry cups over the loins. For three or four weeks after the commencement of convalescence the diet must be carefully regulated and limited to articles that are easy of digestion.

Cholera Nostras or **European Cholera** occurs during hot weather in any part of the world. It is an acute gastro-enteritis that may be excited by errors of diet, exposure to chill when heated, and by the ordinary causes of gastro-enteric catarrh. It is probably connected with bacterial growths in the alimentary canal; and a comma bacillus, somewhat resembling that of Asiatic cholera, has been observed in the rice-water stools. The disease is characterized by an abrupt invasion, vomiting, purging, rice-water stools, muscular spasm in the calves of the legs, thighs, and sometimes extending to the abdomen and upper extremities. In severe cases the symptoms are very like those of Asiatic cholera. An appearance of collapse is not uncommon, but it rarely terminates in death, excepting in the case of weakly children or of enfeebled old people. The duration of the attack seldom exceeds twenty-four or forty-eight hours, though the period of convalescence may be long and marked by considerable debility.

The *diagnosis* is chiefly determined by the exclusion of Asiatic cholera, and the possibility of acute poisoning with corrosive sublimate, arsenic, tartar emetic, tainted mussels, meats, fish, custards, ice cream, and other substances in which bacterial toxines can be developed.

The *treatment* consists, after evacuation of the stomach and bowels has been completed, in the administration of opiates, preferably by hypodermic injection. A quarter of a grain of sulphate of morphia may be thus given every two or three hours until reaction commences. If excessive nausea does not prevent, an eighth of a grain of morphia with ten grains of subnitrate of bismuth may be given every four hours.

The abdomen should be covered with a large linseed-meal poultice into which a drachm of chloroform has been stirred. The extremities should be kept warm by placing bottles of hot water, wrapped in flannel, in the bed. Ice may be given to allay thirst, and brandy also, in teaspoonful doses every ten minutes, till reaction begins. During the period of convalescence a milk diet should be enjoined.

CHAPTER XXV.

TYPHUS FEVER—TYPHUS EXANTHEMATICUS.

LIKE the plague, typhus fever has prevailed endemically and epidemically from the remotest antiquity. Between the two diseases the resemblance is so considerable that by the ancient narrators they were frequently confounded with one another. Alike dependent upon social misery, these twin diseases have followed in the wake of war and pestilence from time immemorial. But with the increase of prosperity and the progress of sanitation both pestilences are receding before the advance of civilization. In America typhus fever is unknown except as an occasional importation from Europe; and upon the eastern continent it is seldom encountered outside of Ireland and Russia.

DESCRIPTION OF THE DISEASE. The fever commences abruptly with headache, chills, physical discomfort, and debility, which in a few hours are succeeded by high fever. The patient complains of great prostration, pain in the head, back, and limbs. The expression of the countenance is dull and heavy, the face is flushed and somewhat swelled, the eyes are red, the pupils are contracted, and the eyelids are thickened. The temperature soon reaches 104° or 105° F.; the pulse ranges above 100; the tongue becomes thickly coated; there is thirst and constipation; there may be cough, and a catarrhal condition of the bronchial and gastro-intestinal mucous membranes. Sleep is uneasy and disturbed by dreams. But the intellectual faculties of the patient, though somewhat sluggish, are not clouded. Between the third and fifth day an eruption appears upon the surface of the body. Sometimes, however, the eruption is tardy in its appearance, or may be entirely absent. It consists of spots, described by English authors as the "mulberry rash." At first they disappear upon pressure, but later in the course of the disease they cannot be thus effaced. They resemble the eruption of measles, though rather darker in color. They cover the body and limbs, but do not often appear upon the face or neck or inside of the mouth. Besides these mulberry-colored spots there are rose-colored spots that disappear upon pressure, and resemble the similar eruption of typhoid and other infective fevers. During the later stages of the fever petechial spots make their appearance in cases that are marked by great severity. They do not disappear upon pressure, are often confluent, dark in color, and may even result in actual sub-

taneous hemorrhages. In addition to these eruptions the skin appears ottled and dusky from numerous minute extravasations and capillary jections throughout the deeper cutaneous layers.

At the expiration of a week the fever sometimes lessens, the skin ecomes slightly moist, the mind clears, and convalescence commences. ut generally the second week is characterized by greater severity in ll the symptoms. There is less redness of the eyes, but the pupils are ontracted, and inflammation may attack the internal structures of the yeball. The sense of hearing becomes less acute or is temporarily bolished. The sense of smell, in like manner, is lost; sometimes there s epistaxis, especially in the early stages of the fever. The tongue ecomes dry and brown; the gums swell; there is a catarrhal condition f the fauces, which are covered with a pasty exudation. There may e difficulty in swallowing, thirst is intense, occasionally there is nausea and vomiting, and constipation may be replaced by diarrhœa. There is no distention of the abdomen, nor any intestinal gurgling. The spleen and the liver are enlarged, the abdominal walls give evidence of tenderness on pressure. As the pulse and the temperature rise or fall the movements of respiration follow suit. There is slight cough, without thoracic dulness or evidence of anything more serious than a bronchial catarrh. The pulse, which was full and strong at the commencement of the fever, keeps pace with the temperature, remaining quite uniformly above 100 beats per minute.

The temperature, which from the outset of the fever reached 104° or 105° F., experiences a slight daily remission until the termination of the fever, which occurs by crisis about the end of the second week. It then falls suddenly and the period of convalescence commences. In all cases, and especially in those of a dangerous character, the skin of the body of the patient exhales a peculiar, musty odor suggestive of putrefaction. These exhalations undoubtedly are charged with the contagion of the disease. The urine is scanty and high-colored, and, as in other fevers, often contains a small quantity of albumin. The nervous system manifests grave disturbances; headache is almost universal, but gradually subsides with the course of the fever. The skin, specially over the anterior portion of the body, is abnormally sensitive, the muscles and the joints frequently give evidence of pain if subjected to pressure or movement. During the first week the intellectual culties are dull and sluggish, and the patient often seems to be half leep. During the second week this torpor passes into a state of stupor coma. Delirium may be present, tonic spasms of the dorsal and cervical muscles may produce partial opisthotonos; convulsions sometimes ur. Insomnia is of common occurrence. In fatal cases the patient y be suddenly smitten down as if by a dose of poison, or if life be longed, he sinks into a typhoid condition, lying upon the back and pping down from the pillow into the bed, unconscious and insensible, dry and blackened tongue visible in the open mouth, respiration w and feeble, the pulse compressible and often imperceptible, the wels evacuating themselves in the bed, the urine being suppressed, whole body exhaling a corpse-like odor; death soon closing the ama.

Mild forms of the disease, however, are not uncommon. In cases the characteristic symptoms are present, but are not marke any great degree of severity or danger.

Abortive forms of the fever are also encountered. These are cases that terminate at the expiration of the first week.

Sometimes a patient manifests a disinclination to remain in bed, an may endeavor to continue his ordinary occupations; or, if he be place in bed, he is liable to make his escape and to walk about, apparently unconscious of nakedness or illness. These cases constitute th *ambulatory form* of typhus fever. In certain epidemics inflammatio of the parotid gland, or of the large veins in the lower extremities, ma occur. Unusual and extraordinary hemorrhages may result from scorbutic condition of the patient, and are always indicative of th gravest danger. Gangrene may attack the extremities and other par of the body, especially those portions that have been weakened b pressure, lack of cleanliness, or local injury. Bedsores, cutaneou abscesses, and pyæmic accidents may also occur. The organs special sense may thus undergo destruction.

PATHOLOGICAL ANATOMY. The *large veins* are distended with blac and liquid blood, which, if clotted, lies in loose and imperfectly coagu lated masses. The *mucous membranes* of the body exhibit an appea ance of hyperæmia or of slight catarrhal inflammation. The *liver* an the *spleen* are generally enlarged and engorged with blood. The *hea* is soft and pale, its right side distended with blood; its *muscular fibr* exhibit a finely granular degeneration. The *lungs* are frequently en gorged with blood, and local pneumonia, even gangrene, may sometime be present. If death occur early in the course of the disease, the *brai* and its membranes are congested. At a later period there is *anæmi* and an *œdematous condition of the tissues*.

ETIOLOGY. It is generally admitted that the contagion of typhu fever owes its virulence to the presence of a microörganism, whic however, has not yet been identified. The infective substance is containe in all the excretions of the patient, and it is transmissible to a ver short distance through the medium of the atmosphere. For this reaso healthy persons who enter an ill-ventilated apartment and breathe th effluvia run a much greater risk of infection than those who handle th bodies of similar patients in the open air. Free dilution of the poiso soon destroys its activity. Clothing and other articles that have bee in contact with the sick may become the vehicles of transmission contagion, especially if they be enclosed in tight boxes or other con tainers that do not admit the air. Water and other liquids do no serve as vehicles for the contagion.

MORTALITY. The degree of fatality depends upon the character the particular epidemic and the special conditions that determine i prevalence. Under favorable conditions, in a rural population, th mortality may not exceed five or six per cent., but in times of war an famine and in the midst of pauperized communities, the mortality ma rise to fifty or sixty per cent. During the Crimean war, where every thing combined to complete the sum of human misery, in certa

pitals every inmate died of the fever. The average mortality, wever, does not exceed fifteen to twenty per cent.

DIAGNOSIS. Typhus fever must be differentiated: 1. From typhoid; . From relapsing fever; 3. From the plague; 4. From measles; . From cerebro-spinal meningitis.

1. From *typhoid fever* it may be distinguished by the greater duskiness of the countenance; by the characteristic mulberry rash; by the rapid rise of temperature, which reaches its maximum in a few hours; by the early termination of the fever and its speedy disappearance by crisis. During the course of the disease the headache and other pains are more frequent than in typhoid fever. Stupor and delirium make their appearance at an earlier period and are more common. Abdominal symptoms also are less marked than in typhoid fever. The belly is not distended, there is no gurgling nor evidence of tenderness in the ileo-cæcal regions. The bowels are usually constipated; the liver is larger and the spleen smaller than what are observed in typhoid fever. Bronchial catarrh is also more frequent and the peculiar odor exhaled by the patient is itself diagnostic.

2. From *relapsing fever* it may be distinguished by the course of the disease without intermission or relapse; by the mulberry rash, which is absent in relapsing fever; and by the bilious and icteroid disturbances which are so frequent in relapsing fever.

3. *Plague* and typhus fever have been frequently mistaken for each other; but the rapid course of the plague and the early appearance of buboes and carbuncles, together with the absence of delirium, are sufficient to distinguish that disease.

4. *Malignant* cases of *measles* not unfrequently resemble typhus fever in certain particulars. But the eruption of measles upon the face and upon the soft palate; the presence of coryza; the normal condition of the liver and of the spleen, and the concurrence of ordinary forms of the disease in other patients, are sufficient to distinguish measles.

5. *Cerebro-spinal meningitis* is characterized by terrible pain in the head and spine; retraction of the neck; frequent vomiting; eruption of herpes from the second to the fourth day; and albuminuria. The mulberry rash is also absent in the meningeal disease, the course of which is usually more violent and rapid than that of typhus fever.

PROGNOSIS. The earlier cases that occur in the course of an epidemic are more fatal than the later. The contagion seems to be attenuated by its transmission from patient to patient. Unfavorable hygienic conditions, previous states of ill health, complications with other diseases, mental depression, discouragement and despondency, all combine to render the prognosis unfavorable. In individual cases the early manifestation of prostration, contraction of the pupils, irregularity and weakness of the heart, continuous delirium, difficult respiration, involuntary stools, suppression of the urine, unusual discoloration of the skin, duskiness of the eruption, the development of a hemorrhagic tendency, excessive pungency of the exhalations, uncommon elevation or depression of temperature, with irregularities in the course

of the fever, and the appearance of intercurrent disease, are all alarming symptoms indicative of probable dissolution.

TREATMENT. The patient must be removed from unhygienic surroundings, and should be taken from the wretched lodging-houses in which the disease usually prevails, and be placed in a thoroughly ventilated hospital pavilion, or under canvas, if the weather will permit such free exposure. The utmost cleanliness of person and of bedding must be secured. The evacuations of the body must be removed and disinfected as speedily as possible. The diet should consist of milk, gruel, and animal broths, which must be given at regular intervals throughout the twenty-four hours. The temperature must be reduced by the employment of cold beverages, cool sponging, and baths of water at a temperature of sixty-five to seventy degrees. An ice-cap upon the head and the application of Leiter's coils about the body will be frequently of service. The bowels may be evacuated by the use of saline laxatives, such as citrate of magnesia or Seidlitz powders. Dilute mineral acids in doses of fifteen to thirty drops may be given every three or four hours. Great prostration of the nervous system may be treated with aromatic spirits of ammonia, with Hoffmann's anodyne, spirits of chloroform, oil of cajuput, and dilute hydrocyanic acid combined with small doses of the deodorized tincture of opium. Camphor and musk are useful in cases marked by a tendency to failure in the circulation. Symptoms of asphyxia require the administration of capsicum and strychnine. Constipation of the bowels may be relieved by enemata. The bladder should be frequently examined, and the urine must be withdrawn by the aid of a catheter if it be retained. During the later stages of the disease, alcoholic stimulants may sometimes be administered with advantage. Quinine should be postponed until the commencement of convalescence, when it and other tonic remedies may be given with great advantage. Gangrene of the extremities, bedsores, and other complications must be guarded against, and appropriately treated if they occur.

CHAPTER XXVI.

THE PLAGUE—PESTILENTIA.

FROM the remotest antiquity vague narratives of epidemic pestilence ravaging the countries of the East, invading the borders of the Mediterranean, and decimating the population of Europe, have come down to modern times. Many of these epidemics were undoubtedly identical with the plague, but the imperfect observation, or lack of observation and medical discrimination, in those early ages, renders it impossible to identify the characteristics of all the historical examples that have been handed down to us. Few diseases, moreover, present greater variety of symptoms than the plague, consequently the historical references to such visitations have undoubtedly made certain features more prominent

one generation, and others in another. It is, however, very certain it this was one of the principal scourges of early civilization along e coasts of the Mediterranean Sea. It was during the Middle Ages, ter the establishment of greater freedom of intercourse with Asia, that e pestilence reached its greatest severity, culminating in the Black eath, as was called the great succession of epidemics that ravaged urope during the middle of the fourteenth century, and in the period f eight years destroyed the lives of 24,000,000 of the inhabitants of at continent. With the progress of civilization and improvement in ie mode of living that characterizes the present century, the plague as become unknown in Europe, and now prevails only at intervals ithin narrow limits in the central regions of Asia.

Description of the Disease. The onset of the disease is usually udden and is marked by serious disturbance of all the functions. here is a feeling of intense prostration, severe headache or vertigo; ie skin is pale; the eyes are sunken, sometimes red, with dilated upils; the voice becomes enfeebled; the patient staggers as if intoxi- ated, and complains of a burning sensation in the nasal passages, iroat, and stomach, accompanied by nausea, vomiting, and sometimes y diarrhœa. After a few hours there is a severe chill, followed by igh fever, intense headache, and thirst. The tongue is moist and overed with a white fur; there is gastro-intestinal pain, and continued omiting. Respiration is accelerated, and the pulse rises above 100 eats. This condition soon passes into a state of profound prostration, ith delirium deepening into stupor and coma; the mouth becomes dry nd filled with sordes; internal heat increases, while the extremities ecome cold. The pulse is small, feeble, and rapid; there are obstinate omiting, bronchial catarrh, and hemorrhage from the nose and other ivities of the body; the urine is scanty, and sometimes charged with ood.

After the fever has continued for two or three days, eruptions appear. ese take the form of buboes in the groins, in the arm-pits, about the k, and elsewhere. Carbuncles also develop upon the body and limbs. ere is copious perspiration, and the fever exhibits a tendency to ission. In fatal cases, petechial spots, bloody wheals, and ecchy- tic patches appear upon the skin. Death may occur at any time ing the course of the disease. If life is prolonged until the remis- n of the fever, which usually occurs from the sixth to the tenth day, buboes or carbuncles suppurate freely, and convalescence commences. covery is usually very slow in consequence of the numerous compli- ons that hinder its course. Numerous abscesses, boils, and other dences of pyæmia are of common occurrence. Dropsy and paralysis metimes appear.

Pathological Anatomy. The membranes of the *brain* and of the *nal cord* sometimes show evidence of ecchymosis. The *veins* are gorged with blood, and the substance of the brain exhibits minute ravasations of blood. The *serous cavities* of the body contain a tain amount of serum that is frequently stained with blood. The *gs* are in a state of hypostatic congestion, the mucous membrane of *bronchi* often exhibits inflammation; and in hemorrhagic cases there

will be everywhere numerous signs of *local hemorrhage*. Similar evidences of congestion and hemorrhage appear throughout the *alimentary canal* as far as the ileo-cæcal valve. The *large intestine* is usually healthy. The *liver* is very greatly enlarged, and the *gall-bladder* is immensely distended with green bile; the *spleen* also is enlarged and softened; the *pancreas* is enlarged and sometimes indurated. The *kidneys* are engorged with blood, which sometimes fills the pelvis and ureters, and even the bladder. The *lymphatic glands* are greatly enlarged and inflamed. The connective tissue around them becomes inflamed, and even gangrenous. Thus are formed the *buboes* and the *carbuncles* that characterize the disease. The *blood* is darkly fluid, and is rapidly decomposed.

ETIOLOGY. It is in the mountainous regions and elevated plains of Central Asia that the plague may be said to be endemic. It prevails in temperate climates, and never invades the tropical regions of the earth for the reason that a high temperature destroys its contagion. Moderate heat and a moist atmosphere apparently favor the propagation of the infection. It is during the winter and spring months that the disease prevails in its native localities, where it thrives in the moist heat of ill-ventilated habitations. Its pandemic prevalence may, however, progress throughout the entire year. Chief among the local causes of the disease are poverty, filth, famine, and war. Differences of sex, age, temperament, and profession exert very little influence upon susceptibility to the disease. Bodily fatigue, all forms of excess, and previous conditions of ill health are active among the predisposing causes.

But the exciting cause of the disease is a definite contagion, the nature of which, owing to the obvious difficulties that attend the research, has not yet been elucidated. It is probable, however, that the contagious matter is a microörganism of bacterial character. This contagious matter is contained in all the excretions and effluvia of the patient, and may be transmitted either through the air, or by the medium of clothing and other articles that have become infected. The contagious element is not rapidly diffusible, being probably of a weighty character. Consequently the disease spreads less rapidly than cholera, though its progress is more rapid than that of typhus fever. It is probable that healthy persons are usually infected through the respiratory passages, but it is not certain that the infection may not invade the body through other avenues of entrance. The period of incubation after exposure varies from a few hours to six or seven days.

TREATMENT. There is no antidote to the contagion of the plague. Many cases are smitten down and die so promptly that opportunity for treatment does not exist. When, however, the disease pursues a more deliberate course, its various symptoms must be treated in accordance with general principles. The intense fever should be antagonized with cold baths and large doses of phenacetine, of which from ten to fifteen grains may be given at once, and should be repeated every two or three hours. Symptoms of gastro-intestinal irritation should be soothed by hypodermic medication with morphine and atropine. Alcoholic stimulants may also be cautiously administered. The tendency to hemorrhage demands the use of aromatic sulphuric acid and other astringents.

uring the formation of buboes and the development of pyæmic inci-nts, the treatment resolves itself into that of pyæmia, and must be nducted in accordance with the principles of antiseptic surgery.

In ancient times it was customary to quarantine plague-smitten atients by imprisoning them in their houses, where they for the most art died without help of any kind. By this mode of treatment the irulence of the pestilence was greatly intensified, and its epidemic rogress was really facilitated. Only when a limited community can e thus thoroughly isolated and sacrificed are such stringent measures justifiable. The most successful method of limiting the disease consists n the removal of infected persons from their homes into temporary hospitals or tents, if the weather will permit, where perfect cleanliness and ventilation can be continually maintained. Healthy people should remove from the infected locality, and should not return until the termination of the epidemic If, however, the population has been previously infected, such removal may be the means of transmitting the disease to distant localities. It is thus that epidemics of the plague have become widely extended. The endangered population should, therefore, be retained as near home as possible, while every provision is made for complete cleansing and disinfection of their habitations. But, above all things, the most important is the prevention of the dis-ease through measures of public sanitation and judicious quarantine. The plague cannot prevail in a cleanly community. Cremation of the bodies of the dead should be practised in preference to earth-burial.

CHAPTER XXVII.

YELLOW FEVER. FEBRIS FLAVA.

Yellow fever is an acute, infective, epidemic fever, characterized by a paroxysm of invasion, followed by a period of remission that is succeeded by a relapse, speedily terminating either in death or in decline and convalescence. It is a disease that occurs endemically in he tropical seaports of the Gulf of Mexico, the coast of Brazil, and e inter-tropical shores of Western Africa. From these localities it diffused epidemically along the lines of ocean travel; and, during e prevalence of warm weather in temperate climates, it may be trans-rted to a considerable distance inland from the seaports which have en thus invaded. It has thus become known in the southwestern rts of Europe, in England, in the maritime seaports of the Atlantic ates of America, and in the cities of the valley of the Mississippi. is a disease that can only prevail when the temperature of the atmos-ere is continuously raised to the level of summer heat; by the first sts of autumn its epidemic progress is at once arrested. For this ason it cannot prevail at any considerable elevation above the level the sea.

SYMPTOMS. The period of *incubation* after exposure to yellow fever is exceedingly variable. It may occupy but a few hours, or it may endure for nearly a month. As a general rule it lasts from one to four or five days.

Period of invasion. The disease commences quite abruptly, most frequently during the night. It may be ushered in with a brief chill, which, however, does not always occur. There is severe headache and intense pain in the loins; sometimes there is vomiting. The *fever* quickly follows, and the temperature in a few hours rises to 104° or 106° F. Having reached this level on the first or the second day, it begins to fall more or less gradually, often with slight oscillations, until the third, fourth, or fifth day, when, in mild cases, the normal temperature is reached, and recovery is established. The *pulse* rises more rapidly than the temperature; at first full and strong, having reached its maximum, it begins to lose its volume and force with the decline of the fever, reaching the normal figure about the sixth or seventh day. In fatal cases it becomes weak and rapid, even with a falling temperature. In mild cases *respiration* is not affected, but in severe forms of the disease respiration may be disturbed by a congested state of the lungs, or by the nervous disorder that accompanies the disease. The *gums* are swelled, the mucous membrane of the *mouth* presents a catarrhal appearance; the *tongue* is at first moist and soft, generally broad and swelled, with a thick white fur, while the tip and the edges are of a bright-red color; sometimes there is no change in the appearance of the organ. A tendency to hemorrhage is often preceded by a red band occupying the centre of the tongue from its tip to its base. As the disease progresses the tongue becomes red and pointed; in hemorrhagic cases it bleeds, and becomes darkly colored. The patient is tormented with *thirst*, which increases with the danger of a fatal termination; its absence is a favorable symptom.

The occurrence of *nausea* and *vomiting* exhibits nothing characteristic at the commencement of the fever. After two or three days the vomited matter consists, in serious cases, of blood mixed with mucus, or a brownish or even a black liquid, constituting what is known as the *black vomit*. The liquid thus ejected resembles an infusion of coffee, with an abundant sediment consisting of altered blood corpuscles, decomposed hæmoglobin, and traces of fibrin. In the worst cases the vomited matters may resemble pitch in color and consistence. Recovery has never been known in such cases.

During the period of invasion the *bowels* are generally constipated, but they become relaxed during the later periods of the disease. Abdominal pain and distention are usually absent, though there may be some tenderness on pressure over the epigastrium after the act of vomiting.

The *urine* is generally less in quantity than during the state of health; in dangerous forms of the disease the quantity is greatly reduced, and may be entirely suppressed. In mild cases the color of the urine varies but little from that of health; but in severe forms of the disease it is acid and high colored, and sometimes deposits a sedi-

t of urates. Albumin is always present in severe cases. Blood also be present in hemorrhagic cases.

n mild forms of the disease the *skin* is warm and moist during the ile stage; as the temperature falls, abundant *perspiration* may take e with great relief to the patient. In severe forms of the disease occurrence of copious perspiration without improvement in the con- on of the patient is a symptom of very great danger.

Various *cutaneous eruptions* are frequently observed during the rse of the fever, such as miliary vesicles, patches of herpes about mouth, various rose-colored spots scattered here and there, some of n resembling mosquito bites, others placed so near together as to mble ecchymoses. Upon the anterior surface of the body, and n the inner surfaces of the limbs, may be sometimes seen pustules, æ, and purple or livid spots of a hemorrhagic character. Ery- matous patches that manifest a tendency to gangrene appear upon scrotum and in the folds of skin most affected by heat and moist- . In the majority of cases, as the fever declines, about the third ourth day, the surface of the body becomes discolored with the hue *jaundice*. At the same time the urine assumes a dark-red color, contains the coloring matter of the bile. These elements only ear in the blood during the latest stage of the disease. The dis- oration of the skin is therefore originated by an alteration of the od itself, rather than by the passage of bile pigment into the cir- ation, an event which only occurs at a period later than the com- ncement of jaundice.

So variable is the intensity and danger of the disease that its course ibits a corresponding difference in severity and prominence of in- idual symptoms. In mild cases there is little to discover besides a er of brief duration, accompanied by the ordinary nervous and retory disturbances that accompany a febrile movement of brief ation. In severer cases the brief introductory chill is followed by igh fever, with headache, rhachialgia, and pain throughout the limbs l joints. The eyes sparkle, the conjunctivæ are slightly injected, pupils are dilated, the skin is hot and dry, or slightly moistened h perspiration. The pulse is full, strong, and frequent; respiration newhat accelerated; nausea and vomiting accompany the onset of fever, and are succeeded by an uneasy sensation at the pit of the mach; the bowels are usually constipated; the urine is scanty and h colored; considerable nervous agitation is sometimes exhibited by patient. After three or four days these symptoms gradually de- e, and the paroxysm of fever yields to a *period of remission*, during ch there is almost complete relief from suffering and fever; but r a few hours, or one or two days, the *second period* of the disease troduced by the manifestation of jaundice. The temperature rises ttle, though the pulse continues to fall; nausea is renewed, and is followed by the act of vomiting. The matter thus ejected is at watery or bilious, but soon assumes a hemorrhagic character, ch in fatal cases becomes more intense and frequent until the ination of life. The tongue becomes dry and brown, or is ked by a red line through its centre. The abdomen becomes dis-

tended and sensitive; black and offensive stools are voided. The urine becomes scanty, high-colored, and albuminous. After two or three days hemorrhage occurs from all the mucous membranes of the body, and into the areolar tissue beneath the skin. There is nervous agitation, insomnia, sometimes delirium, and the temperature rises to about 102° F. After three or four days the severity of these symptoms may begin to moderate, and convalescence may quickly follow, though the jaundice disappears very slowly. In *fatal cases*, however, the patient becomes greatly prostrated. The pulse becomes rapid and feeble, the temperature rises, hemorrhagic discharges increase, vomiting becomes more frequent and exhausting, the stools are passed unconsciously, the urine is frequently suppressed, a worrying hiccough heralds the approaching end; and the patient passes into a state of collapse, or sinks into a condition of delirium or fatal stupor.

PATHOLOGICAL ANATOMY. The *skin* invariably presents the color of jaundice, even when it was not apparent before death. All the *internal organs* of the body exhibit a condition of hyperæmia. Sometimes evidences of *inflammation* or even of *suppuration* may be observed. The *blood* is darkly fluid and decomposed. The *liver* may be nearly normal, or its size is slightly enlarged; its color is gray, brown, or yellow. The central veins of the lobules and the terminal branches of the portal vein are distended with blood. The hepatic cells exhibit evidence of fatty degeneration, being filled with minute drops of oil and granules of pigment. The interlobular connective tissue is œdematous and infiltrated with leucocytes. The *spleen* is seldom enlarged unless previously affected with malarial fever. In cases of brief duration the *kidneys* are enlarged and exhibit evidence of congestion. In severer forms of the disease hemorrhagic points are visible, especially in the cortical portion of the organ, involving the glomeruli. The parenchyma undergoes fatty degeneration, producing the characteristic appearances of the large white kidney. Very rarely the points of hemorrhage become the seat of purulent inflammation. The *walls* of the *capillary vessels* also undergo a fatty degeneration, identical with what is observed in the capillaries of the stomach, liver, and intestinal glands. Similar degeneration of the *supra-renal capsules* has been observed. The transient character of these morbid conditions is shown by the healthy appearance of the organs of patients who have died by accident, or from other diseases, shortly after recovery from yellow fever.

DIAGNOSIS. The diseases with which yellow fever may be confounded are acute bilious inflammatory fever, and malarial fevers. In *bilious inflammatory* fever there is complete remission of all the symptoms on the second day, while in yellow fever remission does not occur before the third or fourth day, and it is less rapidly and completely established than in bilious fever. Albuminuria is rare in the first, but is always present in yellow fever.

Of the *malarial fevers* it is the remittent form that presents a considerable degree of resemblance yellow fever. The malarial disease, however, begins less abruptly than yellow fever, and is characterized by an early appearance of jaundice, by repeated chills, and

issions, which contrast with the single invasive paroxysm and ission of yellow fever. Malarial fever, complicated with *hæmaturia* other forms of hemorrhage, must be distinguished from yellow fever its more continuous or remittent character, and by its occurrence ing the cool season of the year rather than during the warm. The tial chill of malarial fever differs widely from that of yellow fever by greater duration, and by the great prostration that accompanies it, ile the strength of the yellow-fever patient is more rapidly exhausted ring the period of relapse.

From *relapsing fever* yellow fever must be distinguished by the single lapse, and by the greater frequency with which hemorrhage and black mit occur in yellow fever, in contrast with the mildness of the suc- ssive relapses that occur in true relapsing fever.

Acute yellow atrophy of the liver can be distinguished from yellow ver by the slow and insidious commencement of the disease, and by e bilious character of the jaundice that accompanies the invasion of e disease.

PROGNOSIS. The mortality of yellow fever varies considerably in fferent epidemics and in different localities. Negroes and other atives of the tropics experience greater immunity from the disease an the inhabitants of extra-tropical countries. Northerners who xperience the disease on removal to inter-tropical localities where it is ndemic, are exceedingly liable to a fatal result. Consequently the ortality of yellow fever is known to vary from ten to eighty per cent. f the cases.

ETIOLOGY. Yellow fever is propagated by a contagion of which the xact nature has never been determined. It is given off from the odies of patients, and may be transmitted through the air for a short istance. It attaches itself to clothing and other movable articles, ith which it may be conveyed to an indefinite distance. It is thus ransported in cargoes of merchandise from infected seaports to distant ountries where it can never become endemic, but where it may origin- te an epidemic prevalence of the disease until its course is terminated y the advent of cold weather. For this reason it is believed that the ctive agent of the contagion must be a vegetable parasite that cannot rvive the freezing temperature. The commencement of an epidemic marked by the appearance of sporadic cases, which multiply and come more frequent until an entire population may be infected. In e manner, an epidemic gradually subsides, unless suddenly terminated a frost.

Yellow fever is a disease that prevails among the inhabitants of wded cities upon the sea-coast rather than in sparsely settled regions t favor the production of malaria. In these respects it resembles plague and the cholera, with which it forms the triad of migratory tilences. The foul and confined air of ships favors the breeding of contagion, so that the disease may actually become endemic in sels that have been once infected. Only after the most complete and ical disinfection can such craft be rendered safe for the transporta- n of human beings.

The comparative immunity of the negro race has been mentioned.

This immunity depends not upon previous experience of the disease, nor upon hereditary causes, for it is said to be possessed by the African negroes where yellow fever has never been known, as well as by the colored people of tropical America. Mixture with the blood of the white races diminishes immunity in proportion to the degree of admixture. Individual members of other races may acquire immunity, either by prolonged residence in the yellow-fever zone, or by actual experience of the disease, since, like some other infective diseases, it is protective against itself.

TREATMENT. There is no specific form of medication for yellow fever. Its treatment must be purely symptomatic; and in general it may be said that the less active the treatment the better the result. With the commencement of the fever the bowels may be evacuated with castor oil; calomel may be given in doses of a grain every hour until fifteen or twenty grains have been administered, or the whole quantity may be given in a single dose, which sometimes serves to quiet nausea and vomiting. Cold baths must be avoided, but sponging with warm water gives favorable results. Infusions of herbs, such as orange-leaves, sage, or tea-leaves, are highly recommended. Small doses of jaborandi have been used with apparent advantage. During the period of relapse treatment must be adapted to the symptoms. Alcoholic stimulants, especially in the form of champagne, may be administered for the relief of prostration. Anodyne applications may be made to the surface for the relief of pain. Astringents and hæmostatics are generally given in cases of hemorrhage. Suppression of urine requires the application of cups to the loins, followed by poultices or other warm applications. During convalescence the ordinary tonic and dietetic regimen after fever will be required.

CHAPTER XXVIII.

CHICKEN-POX—VARICELLA.

VARICELLA is an infective disease of the skin, characterized by an eruption of conical or hemispherical vesicles that become rapidly pustular, followed by desiccation from the fourth to the ninth day.

SYMPTOMS. *Incubation.* After exposure to the causes of the disease, the period of incubation of varicella is about fourteen days. If the disease be communicated by inoculation, the period does not exceed eight days.

Period of invasion. The eruption often appears without previous disturbance of the health, but in many cases there is an introductory fever that continues about forty-eight hours, and is characterized by the ordinary phenomena of fever. The temperature rarely exceeds 101° or 102° F. Convulsions and other nervous disturbances are occasionally observed among young children.

uption. The eruption is characterized by the appearance of e rounded spots, of a deep-red color, which soon present a papular rance, rising slightly above the level of the skin. After a few the centre of each papule is occupied by a little hemispherical e, which contains a transparent liquid, and is sometimes sur- ed by an erythematous circle. On the second day after their rance these vesicles have reached the size of a small pea, and contents begin to show evidence of purulent infiltration. The f the pustule becomes thickened and dry. It is the commence- f the formation of a scab which soon covers the entire pustule, lls off, without leaving any scar, at the expiration of five to nine rom the appearance of the papule. The eruption commences iminately upon the face, scalp, and body. Vesicles and pustules mes appear within the cavity of the mouth, upon the conjunc- nd on other mucous membranes of the body. The vesicles are ever confluent, and are sometimes very few in number. It lly happens that the eruption appears in successive crops, so ecent vesicles may be discovered in close proximity to pustules e in process of desiccation. In this way the apparent duration disease may be prolonged for double or treble the time occupied evolution of a single pustule.

fever that characterizes the period of invasion disappears with mmencement of the eruption; but in severe cases that are marked ndant pustulation, a slight fever may be observed during the time puration.

certain cases the papular stage of the eruption forms its most con- us feature. The papules do not become transformed into vesicles, ey gradually shrink and disappear after a few days.

certain cases, on the contrary, the vesicular process is exaggerated legree that causes the pustules to assume the formation and char- istics of bullæ, often half an inch in diameter. A distinct zone of nmation forms an areola around the base of each bulla, and ulcera- takes place with rupture of the bulla and the formation of a dis- cicatrix. These exaggerated pustules usually occur as isolated ents in the course of an ordinary eruption, and are the cause of cars occasionally observed upon the face after chicken-pox.

AGNOSIS. The diagnosis of varicella is very easy; yet by the perienced it may be mistaken for smallpox, or for certain cuta- s eruptions. From *smallpox* and from *varioloid* it may be dis- ished by the mildness of the fever; by the rapid evolution of the ion, and by the conical or hemispherical shape of the vesicles, differ from the umbilicated vesicles of smallpox and varioloid. *phigus*, *herpes*, and certain *syphilitic eruptions* are said to resemble ruption of varicella; but the mode of invasion, the peculiarly rapid e of the eruption, and its speedy termination are sufficient to dis- ish chicken-pox from those diseases.

OGNOSIS. Varicella is one of the mildest of diseases, and only complicated by other more dangerous diseases is it ever fatal. *rene*, with fatal results, has been observed among ill-nourished en; and, in rare instances, among patients who appeared to have

been in previous good health. *Nephritis* sometimes occurs as a complication of the disease.

The appearance of the eruption is occasionally preceded by a slight erythematous blush, like that which sometimes precedes the eruption of smallpox or varioloid. It is a transient phenomenon and soon disappears.

ETIOLOGY. Varicella is a disease that may be propagated either by the diffusion of its contagion through the air; by contact with fomites, or by inoculation. The active agent of the contagion is bacterial in its character. Staphylococcus pyogenes aureus, staphylococcus viridis flavescens, and other micrococci have been found in the pustules of varicella.

TREATMENT. Uncomplicated varicella requires no treatment, unless there be a demand for inunction of the skin to relieve the itching which accompanies the eruption. A few doses of antipyrine will suffice to moderate the fever and to allay undue nervous excitement. Complications, if they exist, require their own appropriate treatment.

CHAPTER XXIX.

SMALLPOX—VARIOLA.

VARIOLA is an acute, infective disease, characterized by an initial fever, that is followed by an eruption of papules which become pustular, and are accompanied by a secondary fever.

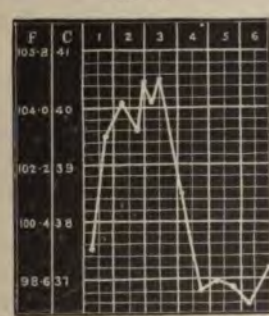
The disease is of Asiatic origin, where it has been known among the Chinese for thousands of years. It is only since the commencement of the Christian era that smallpox has invaded Europe and America. Previous to the discovery of its prophylactic treatment, its pestilential ravages were frequent and deadly, but in modern times its prevalence is the measure of popular ignorance.

SYMPTOMS AND COURSE OF THE DISEASE. From the moment of exposure to the contagion of smallpox till the conclusion of its course, the disease exhibits five successive stages: 1. The period of incubation, of which the duration is variable. 2. The period of invasion, characterized by febrile symptoms which continue for two or three days. 3. The period of eruption, during which there is an outbreak of papules that become vesicular during the course of about four days. 4. The period of suppuration, during which the vesicles become pustular, and an inflammatory fever is developed. 5. The period of desiccation and convalescence, during which the pustules dry up and are covered with scabs that are shed at the conclusion of the process of cicatrization.

1. *Period of incubation.* This stage is usually free from illness, though occasional slight disorders of health have been remarked. The duration of the period is from ten to twelve days, though cases have been reported in which a longer time had elapsed after exposure to the

In such instances the entrance of the contagion into the body
bably delayed by some unusual circumstance.
eriod of invasion. The attack is usually sudden, and is ushered
ills, fever, headache, and intense lumbo-sacral pain. Vomiting
ncommon, the tongue is dry, red at the tip and edges, and is
with a white fur. Young children not unfrequently experience
ions. The temperature rises during the first day to 103° or
. There is a slight remission the next morning, and during the
day a temperature of 106° or 107° F. may be reached. The other
ns of intense fever are present. Occasionally the patient may
delirious. Vomiting almost always occurs. The bowels are
y constipated, though diarrhœa is sometimes observed. Upon
an erythematous or a hemorrhagic rash may appear during
iod. The erythematous rashes resemble the eruptions of scarlet
easles, urticaria, or erysipelas. The hemorrhagic rashes are
rpuric character, accompanied by petechiæ and hemorrhages
e mucous surfaces of the body. The erythematous rashes are
located upon the lower portion of the abdominal surface and in
ins, or upon the thighs as far as the knees. They may extend
e lateral walls of the thorax, and appear upon the inner sur-
the arms as far as the elbow. Their duration may be only a
rs, or they may persist for a number of days; sometimes even
han the characteristic eruption of erysipelas itself.
period of invasion continues from two to four days; its length
er in mild cases than in the severer forms. Occasionally the
presents the appearances of a typhoid condition that may be
ed during fifteen or twenty days before the appearance of the
n.
he period of eruption. With the appearance of the character-
uption of variola there is generally a considerable remission of

FIG. 87.



rature in modified smallpox or varioloid. (WUNDERLICH.) The rapid subsidence
emperature occurs on the third day, with the appearance of the eruption.
ox.)

rile symptoms that mark the stage of invasion. The tempera-
ls, pain ceases, the patient experiences intense relief, and might
idered convalescent did not the surface of the body now present

a number of minute papules that rapidly enlarge and protrude above the level of the skin. These papules appear first upon the forehead, about the mouth, then upon the neck and the thorax, extending in twenty-four hours over the whole body, though less abundant upon those parts of the surface that have been the seat of eruption during the period of invasion. Portions of the skin that have been subjected to previous irritation of any sort are liable to exhibit an earlier crop than appears upon other parts of the body. The papules soon exhibit upon their summits a minute vesicular point, which rapidly enlarges its periphery, becoming translucent and depressed in the centre. The umbilication of the vesicle is produced by a remnant of connective tissue, bands of which divide the little tumor into separate cavities like the sacs that surround the central pith of an orange. This umbilication of the vesicles is less conspicuous upon the face than upon the body.

The evolution of the vesicles occupies three days. Upon the fourth day a red areola appears, surrounding the base of each vesicle. Upon the fifth day the contents of the vesicle become purulent, the surrounding skin swells and becomes painful; the inflammatory process is now complete.

In severe forms of the disease the pustules are placed so near each other that their bases are in contact; upon the face especially the full-developed pustules become confluent. In milder forms of the disease the full-grown pustules are separated from one another by spaces of comparatively healthy skin. In modified forms of the disease the pustules may be few in number and far apart. The first variety is known as *confluent smallpox*, the second as *discrete smallpox*, the third form is observed after prophylactic vaccination, and is called *varioloid*.

The eruption is not limited to the external surface of the body; it may appear within the mouth, upon the conjunctiva, upon the mucous membranes of the nose, in the pharynx and respiratory passages. In these localities the vesicles are soon ruptured, and give origin to little patches of ulceration.

During the period of eruption in discrete smallpox, the fever falls, but during the confluent form of the disease there is only a partial remission of fever, and the patient suffers severely with cough, difficulty of swallowing, and salivation, caused by the eruption within the nasal and respiratory passages. Insomnia and nervous agitation complete the misery of the patient.

4. *The period of suppuration.* In cases of varioloid the vesicles do not suppurate, but in mild forms of smallpox the period of vesiculation is followed by the transformation of the vesicles into pustules. The vesicular liquid becomes turbid through the infiltration of pus corpuscles, and the process of inflammation reaches its height upon the eighth day after their papular appearance. With the commencement of suppuration an inflammatory fever appears, and is characterized by many of the phenomena of the fever of invasion. The skin upon which the pustules rise begins to swell upon the eighth day. The tumefaction increases during the ninth day, but begins to subside upon

the tenth day, and disappears during the eleventh. The loose subcutaneous tissues about the eyes and upon the face become greatly swollen; the eyelids cannot be separated, the features are more completely obliterated than they are during a course of severe facial erysipelas. The hands are considerably swelled, and a similar tumefaction is sometimes observed in other parts of the body. Upon the soles of the feet and upon the palms of the hands, where the skin has been thickened by laborious use, the pustules do not always reach the surface, but may be discerned through the thickened layer of epidermis.

In the *confluent form of smallpox* the period of suppuration is characterized by great swelling of the face and ears, with complete obstruction of the nostrils and closure of the eyes, which remain shut for five or six days. The patient is nearly suffocated by the salivary secretions which decompose in the mouth and throat. There is violent cough, the greatest difficulty in swallowing, and the whole body exhales a most offensive odor. Delirium is not uncommon, pulmonary complications may appear, and death occurs as the result of exhaustion or purulent infection.

5. *Period of desiccation.* With the commencement of suppuration the central portion of each pustule begins to dry, and by the end of the eleventh day after the appearance of the original papule the pustule is covered by a completely formed scab. These scabs begin to fall off about the fifteenth day, and are succeeded by a thin epidermic scale, which in its turn falls off, and is replaced by a thinner covering. Three or four such desquamative crops may follow each other during the course of the following weeks. At the end of from four to six weeks nothing remains of the pustule excepting a depressed and purple cicatrix, which gradually loses its color, but otherwise remains permanently impressed upon the integument of the face. Other parts of the body do not exhibit such pitted scars.

In confluent forms of smallpox the ulcerative process is deeper than in the discrete form. The scabs are larger and thicker, and the cicatrix exhibits the confluent character of the pustules by which they were produced. The fever of suppuration persists for a longer time than in discrete smallpox. There is also a greater liability to serious complications. Abscesses, diffuse inflammations, and necrosis of the laryngeal cartilages may all exist to retard the process of convalescence.

VARIETIES. *Hemorrhagic smallpox.* This form of the disease is characterized by a period of incubation of shorter duration than in the normal form. The period of invasion is marked by more pain in the back, but in other respects the fever presents nothing remarkable. The papular eruption is preceded by the various forms of rash that have been already described. During the fourth or fifth day of the disease, hemorrhagic spots make their appearance over the abdomen and upon the limbs. They rapidly extend themselves and form extensive patches of ecchymosis, sometimes covering the entire surface of the body. Blood escapes from all the mucous surfaces, and is discharged with the urine and other excretions. The serous cavities are also the seats of hemorrhage. The temperature falls; the pulse becomes weak and

rapid; there is intense præcordial distress, and the patient dies in a state of exhaustion, asphyxia, or coma. Occasionally consciousness is preserved throughout the whole course of the disease. In some cases death occurs before the papular eruption makes its appearance; in others, death occurs before the papules have reached the vesicular stage; and in still other cases hemorrhage does not occur until the period of suppuration is reached. Hemorrhage occurs into the pustules, as well as under the forms already described, and death follows eight or nine days after the appearance of the papular eruption. This last variety of smallpox is not always fatal; recovery is occasionally witnessed in spite of the gravity of the symptoms.

It is worthy of note that the hemorrhagic form of smallpox is very commonly observed among the victims of alcoholism. It is also frequent in epidemics of smallpox that prevail for the first time among a population that has had no previous experience of the disease. Pregnancy also predisposes to its occurrence.

Variolæ sine variolis. By this term is described a form of fever witnessed during epidemics of smallpox, in which the symptoms of the period of incubation are accompanied or followed by a rash like that of erythema, measles, or of scarlet fever, without subsequent papular or vesicular eruption. Such cases have been considered to be of variolous origin.

In certain cases of smallpox the period of invasion may continue from four to six days before the appearance of the eruption. Unless other complications intervene, this circumstance does not add to the dangers of the disease.

In certain instances the eruption does not develop beyond the papular stage. These constitute what has been called *warty smallpox*, or *hornpox*. Occasionally the discrete form is accompanied by imperfect development of the eruption, and by an intense fever, with great prostration, and death about the eighth or ninth day.

Varioloid. This name is given to an attenuated form of smallpox in which the comparative mildness of the symptoms is due to a previous modification of the body by vaccination, or to the occurrence of a prior attack of smallpox. It is characterized by moderate intensity of the symptoms, and by the rapid evolution of an eruption which does not reach the stage of suppuration. Upon the seventh or eighth day the pustules begin to dry up, and the patient becomes convalescent without the occurrence of suppurative fever. The duration of varioloid is from eight to fifteen days. Complications may occur, but the prognosis is generally favorable. The disease protects the patient against smallpox and may communicate true variola to other persons.

Complications of Variola. These are very numerous, and are most frequent during the period of suppuration. *Œdema glottidis* sometimes occurs, with a fatal result. *Abscesses*, *ulcerations*, and *necrosis* of the *laryngeal cartilages* are sometimes observed. *Bronchitis*, *broncho-pneumonia*, *lobar pneumonia*, *pleurisy*, *empyema*, *endocarditis*, *myocarditis*, *pericarditis*, and *phlegmasia dolens* may involve the respiratory and circulatory organs. The *pustular eruption within* the *mouth* and *pharynx* is often a source of great distress. *Abscesses* may form

the *tonsils*, *diphtheritic* or *gangrenous processes* may involve the palate and *pharyngeal cavity*. *Diarrhœa* sometimes appears during the later stages of the disease. *Peritoneal inflammations* are rare. *Parotid inflammation* is observed sometimes during the period of eruption, in other cases during convalescence. The *kidneys* may become inflamed, with accompanying albuminuria and dropsy. *Inflammations* of the *ovaries* and *testes* are sometimes observed. *Delirium* is not uncommon during the period of invasion. If it occur during the period of eruption, it is an alarming symptom. Among the victims of alcoholism it is very common during an attack of smallpox, and generally leads to a fatal result. *Maniacal symptoms* are sometimes observed during the period of convalescence. *Paralysis* is sometimes manifested during the course of smallpox, and its gravity is proportioned to the lateness of its appearance. It is supposed to be dependent upon diffuse inflammation of the spinal cord.

Neuritis and *peripheral paralysis* are sometimes observed as a consequence of smallpox, and may be productive of paralyses like those produced by acute anterior poliomyelitis. Sometimes the symptoms of *tabes dorsalis* or of *disseminated sclerosis* are developed, and continue for many months before recovery.

Articular and *periosteal inflammations* of a simple or of a suppurative character occasionally occur.

Intra-muscular hemorrhage is observed sometimes, even in the non-hemorrhagic forms of smallpox. During the period of convalescence cutaneous *abscesses*, *furuncles*, *inflammations* of the *lymphatic glands*, *gangrene* of the fingers, toes, tip of the nose, margins of the ears, mouth, pharynx, larynx, and genital organs sometimes occur. *Ecthyma*, *pemphigus*, *acne*, and other cutaneous disorders may also harass the convalescent patient.

Blindness, as a result of pustulation of the conjunctiva, ulceration of the cornea, iritis, and other forms of intra-ocular inflammation were formerly of very frequent occurrence.

Deafness is sometimes produced by inflammations involving the middle or inner ear, or the basilar meninges. *Other infective diseases* sometimes follow immediately after the course of smallpox. Previously existing diseases are generally aggravated by the intervention of variola, though this rule is sometimes reversed, various chronic cutaneous diseases being dissipated and cured by the intercurrence of smallpox.

Pathological Anatomy. The *papular eruption* is the consequence of a congestion of the dermal papillæ. Each papule marks the seat of one of the vascular cones that are connected with the cutaneous arterioles. As a consequence of the local inflammatory process, the superficial layers of the epidermis are pushed upward by a liquid exudation, and the papule is thus transformed into a vesicle. With the appearance of leucocytes in the vesicular contents, the vesicle becomes pustular, and if the red corpuscles of the blood escape from the capillaries the hemorrhagic form of eruption is developed. During recovery the epidermal base of the pustule is destroyed, and cicatricial tissue takes its place. The papillary structures of the part are not reproduced, and the scar remains permanently depressed. The eruption appears upon

those surfaces only that communicate with the external atmosphere. Occasionally, however, a *quasi* pustular appearance has been noted in the œsophagus and stomach. The *follicular glands* of the intestine are swelled and intensely congested. The large intestine is occasionally ulcerated, and pustules have been seen upon the mucous membrane of the rectum. An imperfectly developed pustulation and ulceration occurs in the *respiratory passages*. Various *pulmonary* and *intra-thoracic lesions* have already been noted among the complications of smallpox, and they may be recognized by their characteristic changes.

The *liver* frequently undergoes fatty degeneration. Diffuse hepatitis and abscesses of the liver have been observed. The *kidneys* frequently present the appearances of diffuse nephritis. The *lymphatic glands* and the *spleen* are enlarged. The *blood* presents the usual appearances that have been observed in the course of acute infective diseases. In hemorrhagic cases ecchymosis and hemorrhage may be discovered in any part of the body. In such cases the capillary vessels contain numerous bacteria, causing the occurrence of embolism, and possibly originating those changes in the vascular walls that determine the occurrence of hemorrhage.

Diagnosis. During the epidemic prevalence of variola the symptoms of the period of invasion will generally suggest the probability of a variolous attack, but in the absence of an epidemic they present nothing decisive as a guide for diagnosis. The cutaneous rashes that appear during this stage may be not unfrequently mistaken for erysipelas or scarlet fever, measles, urticaria, roseola, erythema, miliaria, or even eczema; but a careful comparison of the symptoms that are present with those that should accompany the evolution of such disorders will soon dissipate doubt. The appearance of the papular eruption not unfrequently is mistaken for the evolution of other papular diseases, such as varicella or the papular form of measles; but the variolous eruption may be distinguished, especially upon the face and forehead, by a hard, shot-like feeling that is communicated to the finger when pressure is made upon the eruptive point. Certain *syphilitic eruptions* closely resemble both the papular and the pustular forms of the variolous eruption, but the previous history and the different course of the two diseases will soon suffice to distinguish one from the other.

Prognosis. When smallpox attacks for the first time a virgin population, its ravages are frightful. Whole tribes of North American Indians were destroyed by this pestilence after its introduction upon the American continent. A large part of this excessive mortality is due to the prevalence of the hemorrhagic form of the disease; but in countries where it is endemic, before the introduction of prophylactic vaccination, a considerable degree of toleration is manifested by a population that has been for ages exposed to the disease. At the commencement of the present century, before the general introduction of vaccination, the mortality from variola among the English people in Great Britain and America seldom reached twenty per cent. During the epidemic of 1721, in Boston, the mortality was 14.8 per cent.; in 1730 it was 13.5 per cent.; in 1752 it was 9.7 per cent.; in 1764 it

was 18.5 per cent.; in 1776 it was 9.5 per cent.; in 1778, during the disturbances of the Revolutionary war, it was 34.4 per cent.; in 1792 it again fell to 14.2 per cent. Since the introduction of vaccination the limitation of smallpox has vastly diminished the aggregate prevalence of the disease in civilized countries; but the mortality among those who do experience smallpox is greatly increased. In the London smallpox hospitals, during the present century, from 1836 to 1851, the mortality was 37.5 per cent.; from 1852 to 1867, it was 35.7 per cent. from 1870 to 1879, it was 44.6 per cent. This increasing ratio of mortality is apparently due to a progressive diminution of the hereditary tolerance derived from ancestral experience of the disease.

It has always been observed that smallpox is more fatal during epidemic prevalence of the disease than during its sporadic occurrence. The mortality also increases with the rise of an epidemic, and diminishes with its subsidence.

The most fatal period in the course of smallpox is the stage of suppuration. The period of invasion ranks next in danger; then follows the period of desiccation. Death occurs least frequently during the evolution of the eruption. Hemorrhagic varieties of the disease, and severe confluent forms are almost always fatal. The more discrete the eruption the less the rate of mortality. Severe nervous symptoms, pulmonary complications, and œdema of the glottis, are indications of great danger. Alcoholism, pregnancy, previous disease, or exhaustion, add greatly to the gravity of the prognosis.

Etiology. The contagion of smallpox exists in the contents of the pustules, and it is near the close of the vesicular period of the eruption that its virulence is greatest. Its activity diminishes during the decline of the eruption, but it persists in the scab for a long period of time. The active agent is probably of bacterial character; but which species of the several that are found in the liquid contents of the vesicles is uncertain. Besides streptococcus pyogenes and staphylococcus pyogenes, which produce suppuration, a number of minute microörganisms are known to exist in the virus of smallpox. Similar microbes have been discovered in the lymph of vaccine vesicles. These organisms are probably absent from the liquids of the body, since they have been inoculated into healthy individuals without producing smallpox. The virus of variola adheres to clothing and to everything else that is brought in contact with the patient. In this way the disease may be transmitted from place to place. The dry scabs which are shed from the skin have been known to propagate the disease two years after their fall. The dust that is formed by pulverization of such scabs, may convey the contagion for a limited distance through the atmosphere. The disease may thus be contracted by inspiration of an infected atmosphere. The victim of the disease thus becomes a centre of contagion from the commencement of eruption. Certain facts seem to indicate that contagion may be derived from individuals during the period of invasion, or even of incubation, but it is probable that in all such cases the patient merely shares with others the contagion which he has himself received.

Variola attacks every age, and both sexes; even before birth the infant may become affected by the contagion. In this way may be ex-

plained the apparent immunity exhibited by certain individuals who do not contract the disease after birth.

Like other pestilential diseases the intensity of the virus of smallpox is increased by overcrowding during epidemics. It is for this reason that variola prevails more actively and extensively during winter than during the summer season, when free ventilation can hardly be avoided. Warm weather and sufficient ventilation, however, will not destroy the virus. Epidemics of smallpox prevail in mild climates among unprotected people, with results as serious as those that have been observed in colder countries.

An attack of smallpox usually protects against a return of the disease, but there are occasional exceptions to this rule. Louis XV. of France experienced an attack of smallpox when sixteen years of age. From this he recovered, but died from a second attack when sixty-four years old.

TREATMENT. The hygienic management of smallpox is of the greatest importance. The patient must be placed in a large and well ventilated apartment; his clothing and bedding must be frequently changed. The diet must consist of milk, gruel, and broths. The bowels must be kept open with gentle laxatives. During the stage of invasion, the fever must be treated upon general principles, by cold applications to the head, cool sponge baths, and the internal administration of antipyrine and phenacetine in doses of five to ten grains every four hours. With the appearance of the eruption, these remedies should be discontinued. Insomnia and severe pain in the back require the administration of opiates, but these preparations will be less needful if phenacetine has been administered.

During the period of eruption many remedies have been employed for the purpose of aborting the vesicles in order to prevent the fever of suppuration, and the subsequent pitting of the face that will otherwise disfigure the countenance of the patient. Various masks and imper vious applications to the skin have been employed for this purpose, but with little result. Cauterization of the vesicles with nitrate of silver has been practised, and a favorable result has been sometimes observed but failure has been probably more common than success; and at present the usual practice consists in frequent inunction of olive oil or vaseline.

Internal medication has also been attempted for the purpose of aborting the pustules. Xylol has recently been recommended for this purpose. It is administered in wine, to the amount of thirty to fifty grains a day; or it may be employed according to the following formula:

℞.—Xylol. ℥ijss.
Aq. menth. pip. } āā ℥iss.
Aq. font. }
Syr. cinnam. } āā ℥ss.—M.
Mucil. gum. acac. }
S.—Take a teaspoonful every two hours.

For the same purpose an injection of a two per cent. solution of cocaine may be employed every six or eight hours, but the depressing

fects of this drug must not be forgotten. A warm bath may be given ice or twice each day, and the limbs may be wrapped with cloths rung out of warm water during the intervals between the baths. After ach bath the skin should be powdered with the *pulvis salicylicus cum lco* (salicylic acid 3 parts, starch 10 parts, talc 87 parts). At the ext bath this should be washed off with soft soap, and again applied fter removal from the water. The face may be covered with a sali-ylic acid paste composed of the following ingredients:

℞.—Acid. salicylic. ℈ij.
Amyl. pulv. ℥j.
Glycerin. ℥ij.—M.

Resorcin or iodoform combined with vaseline are useful applications. Recently it has been proposed to spray the face three or four times a day with a solution of corrosive sublimate in alcohol and ether, according to the following formula:

℞.—Hydrarg. corros. chlorid. } āā . . gr. xv.
Acid. citric. }
Alcohol. ℥jss.
Ether. q. s. ad ℥xv.—M.

During the operation the eyes should be protected by a bandage dipped in a solution of boric acid.

During the period of suppuration salicylate of sodium, in doses of fifteen to twenty grains every two hours, will rapidly reduce the temperature, and diminish the amount of suppuration and subsequent pitting.

Ether and opium have been highly recommended for the prevention of suppuration. A syringeful of ether should be injected beneath the skin twice a day, and at the same time fifteen or twenty drops of deodorized tincture of opium should be administered. The treatment should be commenced early in the course of the eruption, otherwise it will not produce satisfactory results. The injections should be made upon the outside of the leg, between the shoulders, or in the lumbar region, in order to avoid the nerve trunks, since they are sometimes paralyzed by ethereal injections. Under the influence of this treatment, it is claimed that the pustules are aborted, and that the course of the disease is considerably shortened. It is, however, useless in hemorrhagic forms of smallpox.

During the stage of suppuration, the mouth and throat should be frequently cleansed with antiseptic gargles, such as a three per cent. solution of boric acid; or chlorate of potassium, one drachm in a pint of water; or salicylic acid, eight grains to the pint. In severe cases complicated by œdema of the glottis, the surgical measure of scarification, even of tracheotomy, may become necessary. Suppurative fever must not be treated with depressing remedies. Antipyrine and its congeners should be avoided, and the temperature should be reduced by the use of cold baths and sponging. The delirium which often occurs in cases complicated by alcoholism, may be relieved by rectal injections containing thirty or forty grains of chloral hydrate. The strength of the patient must be sustained by the frequent administration of egg-nog

with cardiac stimulants, such as camphor, nux vomica, and capsicum. During convalescence the ordinary rules of diet must be observed, along with the use of tonics and restoratives. Against the hemorrhagic forms of the disease, medicine seems almost wholly powerless. Abscesses, secondary eruptions, and other disorders that occur during the period of convalescence, must be treated in accordance with general principles. Warm baths will always be found useful so long as the skin remains in an unhealthy condition.

Inoculated Smallpox. From time immemorial the practice of inoculation for smallpox has prevailed in China and in the countries of the East, for the purpose of producing a mild form of variola, by which the patient is protected against subsequent attacks of the disease. This method of treatment was introduced into England in the early part of the last century by Lady Mary Wortley Montagu, who had observed its utility in Constantinople. Previous to the discovery of vaccination, inoculation was extensively practised as a prophylactic against virulent smallpox. The mortality of the disease when thus contracted did not exceed three in a thousand, among the patients in the London Inoculation Hospital. Special hospitals were provided for the reception of individuals who desired inoculation. They were prepared for the operation by regulation of the diet, and by the administration of laxative medicines. The virus was taken from selected patients who exhibited the discrete form of smallpox, and it was inserted, usually by puncture, upon the upper arm. Upon the second day after inoculation, the puncture became reddened and elevated. Upon the fifth day the papule became vesicular; and upon the seventh day pustulation was complete. A red ring then appeared about the circumference of the pustule, and enlarged its borders during the eighth, ninth, and tenth days. Upon this areola appeared ten or fifteen small *satellite pustules*. The neighboring lymphatic glands were enlarged, but their swelling subsided about the fourteenth or fifteenth day. The scab that was formed during the period of desiccation fell off at the expiration of three or four weeks. During the pustular stage, considerable fever was usually observed. In mild cases the satellite pustules failed to appear, and sometimes the secondary eruption was manifested without evolution of the pustule at the point of inoculation.

The principal advantage of inoculation consists in the greater immunity against subsequent smallpox that is thus conferred, an immunity that is superior to the results of vaccination. The disadvantages of the method consist in the occasional development of severe variola after inoculation, and in the fatal result that sometimes follows the operation. By this method, also, the disease is continually perpetuated in the community, and might become epidemic among unprotected individuals. For these reasons the practice of inoculation has been discontinued in all countries where vaccination has been introduced.

Vaccination consists in the inoculation of variolous virus that has been modified and attenuated by propagation through the bovine race. It was a matter of common observation, wherever smallpox prevailed, that during epidemics of that disease the udders and teats of cows were sometimes affected by an eruption that resembled the eruption of variola.

was communicated from animal to animal by the hands of milkers, o themselves sometimes contracted the disease. It appeared upon e hands wherever an abrasion or other cutaneous wound gave opportunity for inoculation. Among the farming population of England, illiam Jenner, then a young surgeon living at Sudbury, discovered a evalence of the belief that milkmaids whose hands had been made re in the way thus described would never contract smallpox. His riosity was aroused, and he made many observations with regard to hat is called *cowpox* in cattle. He finally became convinced of the ophylactic character of the inoculated cowpox when communicated the human subject; and in 1796 he vaccinated a patient with lymph om the cow. The result proved satisfactory, and after a number of periments in which he vaccinated numerous patients with virus transitted from arm to arm, in 1798 he published his discovery to the orld. After a brief period of contention and experiment, the value the process became fully established, and, from that day to this, vacnation has superseded the old method of inoculation and every other ophylactic measure as a preventive of smallpox.

For a long time it was believed that the vaccine disease originated dependently of variola, but it has been finally established to the satfaction of all but the French school that the two diseases have a mmon origin in the virus of smallpox. Cowpox may be produced, ough with difficulty, by inoculation of the cow with smallpox virus, d the disease thus modified may be transplanted back again to the uman subject, with the propagation of genuine vaccine disease. It as, however, been observed that vaccine lymph thus produced possesses degree of virulence that approaches that of its original source. The tensity of the virus may be diminished by successive transmissions rough the cow, and it is still further attenuated by transmission rough the human subject. In this way a modified and manageable *ovine virus* may be cultivated that will prove itself efficiently prophyctic against smallpox without the production of great disturbances, ch as have been noted when use has been made of fresh cowpox virus at is only recently derived from its virulent source in the contagion variola.

When *vaccine virus* is inoculated upon the human subject by punre, the period of incubation lasts about forty-eight hours. At the end that time a slight papular redness appears at the point of introduction. On the third or fourth day the little papule begins to assume a sicular appearance, and rapidly enlarges. The vesicle usually presents umbilicated appearance, and in form the structure is identical with the sicle of smallpox. On the seventh or eighth day the translucent ntents of the vesicle grow turbid from an infiltration of pus corpuses. At the same time an inflammatory areola shows itself around the stule and continues to extend itself for two or three days longer. stulation is now complete. The process of desiccation commences at e umbilicated centre of the pustule, which gradually dries into a ab beneath which the process of cicatrization takes place. During e third week after vaccination the scab becomes dry and hard, and is ually shed about the twentieth day. The scar that remains is con-

siderably depressed, and is at first of a purplish color, that gradually fades into a dead-white cicatrix marked by numerous minute depressions or pits.

The development of the vaccine vesicle is attended with considerable local irritation that is sometimes accompanied by a general febrile movement during the period of pustulation. The neighboring lymphatic glands are often enlarged and somewhat painful. During the period of desiccation there is often intense itching in the neighborhood of the pustule, which sometimes leads to its rupture by scratching. In this way the original lesion may become inoculated with pyogenic or erysipelatous bacteria, which may cause tedious ulceration or diffuse inflammation.

The effects of vaccination are usually more intense when performed with bovine virus taken directly from the cow. The prophylactic effect is also more complete, and is in great measure proportionate with the severity of the symptoms that follow inoculation. By long-continued employment of humanized vaccine virus, such as has been used in England for nearly a century, the effects of vaccination are considerably mitigated in severity, with a corresponding deterioration of the prophylactic result. It has been observed that in countries where such attenuated virus is used, the occurrence of smallpox after vaccination is a gradually increasing quantity. During the early years of the present century vaccination was scarcely ever followed by smallpox on subsequent exposure, but during recent years such an event is not uncommon, especially where bovine virus is not employed. So close is the relation between the degree of constitutional disturbance that is produced by vaccination and its prophylactic effect that it is considered necessary, at the present time, to practise vaccination by the insertion of the virus at not less than four different points upon the arm. By this method considerable inflammation and a high grade of constitutional infection is attained, especially when bovine virus is employed. The use of active virus of this character is sometimes followed by the appearance of satellite pustules upon the areola, like what are observed after inoculation with smallpox virus. It occasionally happens that an imperfect attempt at eruption occurs over the surface of the body, but this is very rare when ordinary virus is employed.

Irregular forms of *eruption* are sometimes observed after vaccination. The period of incubation may be delayed for a number of days; sometimes a considerable papule makes its appearance, but remains as an indolent purple tumor, that finally disappears after one or two weeks. Sometimes after such retardation of development an imperfect vesicle may occur; in certain cases the vesicle does not present the normal umbilicated form, but is cone-shaped or otherwise irregular in its form. All such departures from the normal standard should be considered as abortive processes that do not confer the necessary protection against smallpox.

In the majority of cases the prophylactic effects of vaccination persist through life, but in many instances, after a variable period of years, the individual again becomes susceptible to the invasion of smallpox. For this reason *re-vaccination* is necessary. As a precautionary

easure this may be advantageously performed whenever an epidemic smallpox is imminent. It is also advisable to perform re-vaccination , or shortly before, the age of puberty, and after the occurrence of y severe illness.

Mode of vaccination. The operation should be performed during the riod of infancy. If smallpox be prevalent in the community it ould be performed immediately after birth, but under other circumances it may be postponed until the child is three months old. It ould, however, be performed before the commencement of dentition, as to avoid the period of disturbance that sometimes accompanies e eruption of the teeth. It is desirable to choose for the operation a me when the health of the patient is undisturbed by other causes, ough slight ailments or even acute diseases need not contra-indicate accination in case of exposure of an unprotected person to smallpox. he favorite point of vaccination is over the insertion of the deltoid muscle n the upper part of the left arm, though other locations are sometimes referred for the better concealment of the resulting scars. The skin hould be cleansed with soap and water, or with a solution of boric acid, and noculation may be performed either by the introduction of fresh lymph btained by puncturing a vesicle of the seventh day upon the arm of a previously vaccinated subject, or with virus prepared by dissolving a ecent scab in water, or by inserting a fragment of such a scab into a ittle pocket under the skin made by an oblique puncture with the oint of a lancet. The preferable method, however, consists in the mployment of bovine virus freshly taken from an inoculated calf, and dried upon little ivory points. The skin should be scarified by making numerous cross-cuts with the point of the lancet, just deep enough to cause the appearance of a slightly sanguinolent lymph. Upon the surface thus laid bare the moistened ivory point should be rubbed till the virus which it bears has been transferred to the denuded skin of the patient. The arm should then be exposed to the air until the lymph has coagulated and dried upon the point of inoculation, or the wound may be protected by a piece of thin court-plaster. After a day or two, this covering may be removed so that the process of vesiculation shall not be disturbed. The fever and other disturbances that follow uncomplicated vaccination seldom require treatment with anything more than simple palliative measures.

CHAPTER XXX.

HYDROPHOBIA—RABIES.

HYDROPHOBIA is an acutely virulent disease that in man always esults from inoculation with the saliva of rabid animals. It prevails rimarily among wolves, foxes, dogs, cats, and occasionally among erbivorous animals. It has never been known to originate spontaneusly, but is communicated from one animal to another through wounds

inflicted by the teeth. It may thus be communicated to nearly all mammiferous animals.

ETIOLOGY. The virus is contained in the saliva of rabid animals. When brought into contact with a wound or an excoriated surface, it is absorbed, and, after a variable period of incubation, produces the phenomena of the disease. According to the statistics collected by Pasteur, one in six persons who have been bitten by mad dogs experiences hydrophobia. The bite of the mad wolf is much more dangerous, probably because of the greater severity of the wounds thus inflicted. Pasteur states that in Russia certain death is supposed to follow the bite of a rabid wolf. Babes reports forty-two fatal cases among forty-six cases of wolf-bites occurring in Roumania. There is no difference between the virus derived from the wolf and that of the dog. The only apparent cause for greater mortality in one case than in the other appears to exist in the greater severity with which the wolf lacerates his victim.

There is great difference in the fatality that follows wounds inflicted upon different parts of the body. A bite upon the head, hands, and other uncovered portions of the person, is far more fatal than if the teeth of the dog have passed through the clothing of the individual before reaching his skin. The virulent saliva is wiped off from the teeth as they pass through the clothing, so that very little, if any, remains to infect the wound. According to Brouardel, of two hundred and seventy persons bitten by mad dogs, one hundred and fifty-two died of hydrophobia, and of that number one hundred and twenty had been wounded upon the face and the hands.

Notwithstanding the evidently infective character of hydrophobic virus, it has at present been impossible to discover any microörganism that can be positively considered as the active agent of contagion. Many observers have discovered various species of bacteria in the nervous tissues of rabid animals, and cultures of these organisms have occasionally produced symptoms of rabies in animals after inoculation. But nothing decisive has yet been reached in this direction. It is only certain that the infective agent exists in the saliva and in the nervous tissues of rabid animals. The experiments of Pasteur and of his pupils have shown that not only the nervous tissues but also the salivary glands, the pancreas, the lachrymal glands, and sometimes also the lymphatic glands, contain the virus. When introduced into the circulation of a healthy animal, either through the lymphatics or through the veins, after a period of incubation it produces the symptoms of rabies. It is in the brain and in the spinal cord that the contagion is chiefly localized. Hence the most certain method of communicating the disease from one animal to another consists in inoculation by injecting under the dura mater a few drops of the liquid prepared by triturating with a little water or sterilized broth a fragment of an infected brain or spinal cord.

SYMPTOMS. The period of *incubation* is of variable duration. The shortest period is from one to two weeks, but most frequently it is in the course of the second month that the disease is manifested. It is rarely postponed beyond the third month after inoculation, though cases apparently well authenticated have been published in which the

od of incubation was believed to have lasted for fifteen or eighteen ths. The period of incubation is usually less when inoculation has n place upon the head and face than when it has occurred upon the s or other parts at a distance from the brain. The period of *inva-* is sometimes preceded by darting pains in the scar of the wound, sensation of numbness or coldness in the injured part.

n certain rare cases the development of hydrophobia consists in the id manifestation of general spinal paralysis, closely resembling the ptoms of acute ascending paralysis. This constitutes the *paralytic* *n* of the disease; but in the vast majority of cases the paralytic ge is preceded by a period of depression that is followed by muscular sms and general nervous excitement. The period of invasion suc-ds to the occurrence of cicatricial pains that radiate from the scar of wound. It is characterized by depression of spirits, headache, de-ty, a disposition to shun society, and an apprehension of impending ess. Sometimes, instead of depression, there is exaltation of the ans of sensation, and an intellectual excitement accompanied by a position to muscular exercise which finds vent in the act of walking. e patient walks and wanders aimlessly until quite exhausted. This ge of the disease may continue from two to eight days; it is then rged into the stage of nervous exaltation. The first evidence of this nge is furnished by the muscles of respiration. There is præcordial tress and a feeling of difficulty in the respiratory movements. Brief sms of the respiratory muscles succeed one another with intervals of iable duration. During these attacks the patient catches his breath e a person who steps naked into very cold water. The pharyngeal l laryngeal muscles soon share in the spasm, and then begin the nomena of hydrophobia. Urged by thirst, the patient desires to nk, but the contact of water with the lips and cavity of the mouth ites violent spasmodic contractions which involve all the muscles of glutition and of respiration. Even the sight of water, or the sound the liquid as it flows, or the thought of drinking, are sometimes ficient to arouse these spasmodic attacks. It occasionally happens t certain liquids other than water can be swallowed, but such cases rare. Usually every effort at deglutition is followed by spasm.

After a day or two the dry and thirsty mouth becomes moistened by excessive flow of saliva. The patient experiences an irresistible pulse to expectorate the frothy liquid, which is sometimes thus in-untarily ejected upon the attendants. The eyes are reddened, and pupils are considerably dilated. Every sense becomes exalted, lucinations may occur, and the cutaneous hyperæsthesia is so intense t the slightest current of air is sufficient to arouse a convulsive roxysm. Even the vapor of chloroform, inhaled for the purpose of ducing anæsthesia, may by its odor and by its reduction of tem-rature produce intolerable spasms.

As the disease progresses, general convulsions replace the local smodic crises; the voice becomes hoarse, and convulsive cries are ered which have sometimes been fancifully likened to the barking of log. The patient cannot remain quiet, but must move himself, etimes leaping from the bed, walking, running, or dashing his head

against the wall of the apartment in which he is placed. These paroxysms become more frequent, and their duration increases, causing the patient sometimes to resemble a maniac; though in the intervals between the paroxysms the mind remains clear, and consciousness is perfect. These lucid intervals are marked, however, by great depression of spirits and a confident anticipation of impending evil.

As the disease progresses the temperature rises, sometimes reaching 109° F., the pulse becomes more frequent, the skin is covered with perspiration, the urine is scanty and voided sometimes with difficulty, the bowels are constipated, venereal excitement may arise, the patient sinks into coma followed by death; or the end may come suddenly through paralysis of the heart. The duration of this stage of the disease rarely exceeds one or two days.

In certain cases the period of excitement is followed by complete collapse and paralysis that lasts for several hours before the fatal termination of the disease. In the majority of cases death occurs upon the third or fourth day after the commencement of the disease. Recovery is unknown. Reported cases of cure have been probably dependent upon an error in diagnosis.

DIAGNOSIS. The disease may be simulated by an *imaginary hydrophobia* in nervous persons who have been bitten by dogs that were not rabid. In such cases the duration of the disease and the character of the symptoms depart widely from the classical features of genuine hydrophobia. In certain cases of *hysteria* the fear of water may become a prominent symptom; but the history of the case, the absence of inoculation, the duration of the disease, and the rarity of a fatal termination suffice to indicate the real nature of the attack.

It is probable that the phenomena of *tetanus* have been frequently mistaken for those of hydrophobia. In this way may be explained many of the narratives related by the older authors who have described a fatal result, preceded by convulsions or spasms, subsequent to a bite inflicted by a non-rabid animal, or by a human being who was simply under the influence of passionate fury. The two diseases differ in the fact that tetanus usually appears within ten days after the wound, while hydrophobia in the majority of cases is developed during the second or third month after inoculation. Tetanus is ushered in by the manifestation of trismus, which is almost always absent in hydrophobia, in which disease the spasmodic phenomena are manifested in the muscles innervated by the medulla oblongata and the upper portion of the spinal cord, while the tetanic spasm is general throughout the muscles of the body and limbs.

Epilepsy has been occasionally mistaken for hydrophobia, but the history and course of the disease should obviate the possibility of such an error.

The convulsions of *uræmia* may be differentiated from those of hydrophobia by a fall of temperature that contrasts with its rise in hydrophobia.

Certain cases of *delirium tremens* may resemble hydrophobia; but the delirium and hallucinations of the alcoholic disease are among the earliest symptoms, while in hydrophobia their occurrence is near the

ation of the disease. Difficulty of respiration and pharyngeal are among the earliest symptoms in hydrophobia, and are among est in delirium tremens. There is, however, a sufficient degree semblance between the worst forms of delirium tremens and phobia to embarrass the diagnosis, and to account for many of nomalous cases of alleged hydrophobia.

THOLOGICAL ANATOMY. The *blood* is dark-colored and disorgan- ike that which is found in the bodies of those who have perished the eruptive fevers. The capillary vessels of the *brain*, *spinal* and *nerves* are intensely congested. A slight extravasation of is sometimes observed in the pia mater. The *respiratory pass-* are filled with mucus, and the *mucous membranes* are deeply sted. The *lungs* are also congested, and sometimes contain rrhagic infarctions. The pulmonary tissue is often emphysema-

All these phenomena are the result of prolonged respiratory n. The *kidneys* exhibit evidences of incipient catarrhal inflam- n. Minute, disseminated foci of acute inflammation have been ved in the *brain* and in the *spinal cord;* but nothing character- or sufficient to account for the symptoms has been discovered by rdinary methods of examination.

EATMENT. The treatment of developed hydrophobia resolves into a "meditation upon death." Innumerable remedies have essayed for the cure of the disease, but without any positive suc-

The patient should be placed in a dark room, remote from s and sounds and currents of air, in order to avoid excitement of yperæsthetic nerve tissues. Hypodermic injections of morphine, he injection of solutions of chloral hydrate into the rectum, have times given temporary relief, but they in no way modify the course e disease. The only hope of safety for the patient lies in the tion of the *prophylactic treatment* introduced by Pasteur. As lily as possible after the infliction of a wound by a rabid animal, point of inoculation should be destroyed, by causing it to bleed y, and by the application of the actual cautery, or some other lly efficient caustic. The patient should then be subjected to vac- tion with the attenuated virus of hydrophobia, according to the od described by Pasteur in a communication to the Academy of nces, October 26, 1885, in which he related his experience with first human subject thus treated. The patient was a boy, nine s of age, named Joseph Meister, who had been bitten upon the l and thighs July 4, 1885. The wounds had been cauterized carbolic acid twelve hours after their reception. During ten days patient received thirteen injections of an attenuated virus, and has r experienced, during the years that have followed, any symptoms ydrophobia. The publication of this result brought to the labora- of Pasteur, from all parts of the world, persons who had been n by rabid animals, so that in 1890 the number treated by Pasteur his assistants had exceeded eight thousand. Of this number a e proportion undoubtedly would never have experienced the disease they remained untreated; but still the results of treatment in s of unquestionable inoculation with rabid virus have demonstrated

the vast superiority of this method over any other that has ever bee employed. In the course of his experiments Pasteur had discovere that by inoculating a series of animals with virus obtained from th spinal cord of the earliest fatal case in each group of the series, it wa possible to intensify the energy of the virus with each remove from th first member of the series. By this method the period of incubation i a series of rabbits may be reduced from fifteen days to six or seve days, at which point the intensity of the virus appears to become sta tionary. The process may be reversed, so that by employing viru derived from the rabbits that have survived longest after inoculation, virus may be produced, after a number of successive generations, tha requires the longest period of incubation before the development hydrophobic symptoms. Having thus determined the possibility modifying the intensity of the contagion, Pasteur experimented wit the view of effecting modification in the intensity of the infecti agent after its removal from the body of the rabid animal. Havin ascertained that the brain and spinal cord contain the virulent agent its most concentrated form, he found that by suspending the spin cord of a rabid animal in a sterilized atmosphere, the intensity of i virus progressively diminished each day as it dried, until at the end two weeks it became wholly inert. Being provided with such a seri of drying spinal cords, the animal chosen for experiment is vaccinat on the first day by injecting hypodermically an emulsion prepared triturating in water a portion of the spinal cord of the fourteenth day the weakest form of the virus. Upon the second day the animal injected with similar virus from the cord of the thirteenth day; on third day with virus from the cord of the twelfth day, and so on, e day with a stronger virus, until the cord of the second or first da reached. Dogs that have been thus treated may then be injected fresh virus from the rabid animal without any unfavorable result. T are *refractory to inoculation.*

For the vaccination of human subjects, virus prepared by desicca of the cords of rabbits that have died after inoculation is emplo The procedure is essentially the same as that already described for protection of dogs. The treatment is continued for ten days. E day the patient receives by hypodermic injection one or two gram of a liquid of which the virulence is increased from day to day. Du the last day or two, the point of inoculation is surrounded by an thematous redness, and there is considerable itching of the adja integument. The patient is then allowed an interval of one day w out treatment. Upon the twelfth day he is inoculated with virus f cords of the eighth and seventh days; upon the thirteenth day virus is taken from cords of the seventh and sixth days; upon the f teenth day from the cords of the sixth and fifth days; upon the fiftee day from cords of the fifth and fourth days; on the sixteenth day one gramme of virus from cords of the fourth and third days. seventeenth day passes without treatment. From the eighteenth to twenty-sixth days the patient is inoculated each day with two gram taken successively from cords of the eighth, seventh, sixth, fifth, fou and third days, after which treatment is suspended. This method

been varied by different experimenters who have practised *intensive inoculation* by reducing the interval between the successive injections from one day to twelve hours, or even less. Great success has attended the intensive method of inoculation as practised in the Pasteur Institute at Chicago, where the aggregate mortality thus far has been less than one per cent.

The mortality among patients subjected to this method of treatment at the Pasteur Institute in Paris was one and thirty-four one-hundredths per cent. in 1886; one and twelve one-hundredths per cent. in 1887; seventy-seven one-hundredths of one per cent. in 1888; fifty-four one-hundredths of one per cent. in 1889; thirty-two one-hundredths of one per cent. in 1890. Similar results have been obtained elsewhere; so that, although the method of treatment by vaccination does not afford an infallible means of prophylaxis, it ranks among the greatest therapeutical discoveries ever given to the world.

CHAPTER XXXI.

ON THE MANAGEMENT OF INFECTIVE DISEASES.

The attempt to control the prevalence of infective diseases resolves itself into two distinct, yet nearly related lines of action. The personal care of each individual patient falls within the province of the attending physician, and he alone is responsible for the necessary medical treatment. But the care of the public health is in every well-regulated community specially delegated to the regular staff of the health office. The duties of this office are divided between the prevention of imported diseases and the supervision of domestic pestilences.

The discovery, a few years ago, that the majority of infective diseases are due to the invasion of parasitic microörganisms, was accompanied by the belief that such diseases inevitably follow exposure to their contagia, and that if such contagia could be avoided or destroyed the infective disease might be completely and forever arrested. The majority of the methods for the prevention of spreading diseases that are now in use were based upon this belief, but with the progress of investigation it appears that the parasitic contagia of many diseases are so widely and so abundantly disseminated that by no precaution can they be avoided. The existence and production of immunity against disease was not then understood as it is at present, though here and there thoughtful observers did not fail to recognize the fact of such immunity. It consequently has become necessary in some respects to recast many of the rules and sanitary regulations that were formulated a generation ago.

It will be found nearly always impossible in dealing with the majority of mankind to secure those ideal conditions which are most favorable to the recovery from sickness and the safety of the community.

It is, however, well to keep in mind an ideal state toward whic
efforts of the physician should be directed, even though it be impos
to realize anything more than a partial approach toward that perfe
which only wealth and boundless resources can afford.

So far as possible the sick should be separated from the well. W
this can be effected in the home of the patient he should be placed
separate apartment remote from the rest of the family, and shoul
visited only by the physician and by the necessary attendants.
sick room should be large and airy, with an open fireplace, in whi
sufficient fire should be kept during the winter, in order to insure
cient ventilation and warmth. The floor should be uncarpeted;
walls either painted or whitewashed; the windows provided with si
screens, without hangings or heavy curtains. The utmost cleanl
should be maintained in all the surroundings of the patient, and al
excreta should be removed as soon as voided, and thoroughly disinf
with milk of lime, in typhoid fever, or with carbolic acid, permang
of potassium, or other disinfectants, as the particular disease
require. In order to prevent the escape of the effluvia into other
of the dwelling, the door of the apartment should be guarded
sheet hanging upon the outer side of the door-frame. It has
advised by some authors to keep such a curtain saturated with
infecting fluid, but such an expedient will be rendered unnecessa
the use of a Canton-flannel curtain, or by the employment of a
forter wadded with cotton, which forms a filter much more effect
arrest microphytic organisms than a simple piece of sheeting t
only occasionally moistened with a disinfecting fluid. In dealin
infective discharges, like those from the mouth and throat in c
diphtheria, it is advisable to receive them upon soft rags that c
immediately burned without removal from the sick room. Clo
articles of bedding, and other objects that have been in contac
the patient, should be placed in a disinfectant solution before re
from the apartment, that they may not convey contagion to thos
receive them to be washed. In all things the utmost clea
should be practised, and by the aid of abundant soap and hot
and the ordinary solutions of carbolic acid or permanganate of
sium, corrosive sublimate, boric acid, etc., such cleanliness m
secured without difficulty, especially when supplemented by the fr
baths that are demanded as a part of modern medical treatment.

Diseases that are followed by desquamation, like scarlet feve
measles, require the use of vaseline or other unguents during the
of convalescence, in order to prevent the diffusion of epidermal
through the air. Such applications should be rendered disinfect
the addition of resorcin, salicylic acid, boric acid, eucalypto
other similar substances. By their use and by the employment o
baths and disinfectant soaps, the period of desquamation and of
tion may be shortened at least two weeks after scarlet fever. In
case the physician should seek by the use of safe and efficient dis
ants to destroy the infective excreta and effluvia by which the d
may be propagated.

The time of isolation must vary according to the disease

according to the individual peculiarity of the patient, consequently it is impossible to lay down any fixed rule that will be effectual to prevent by quarantine the communication of disease. Some cases of scarlet fever cease to be infective within a few days after the disappearance of acute symptoms, while others may communicate the disease for six weeks or two months. A diphtheritic patient may sometimes continue infective for many months after the appearance of the first symptoms of his disease. The principal reliance, therefore, should be placed upon disinfection on the part of the patient, and upon the production of immunity on the part of the well.

After the occurrence of infective disease in a house or apartment a thorough cleansing of the premises should be effected. It has been advised to burn sulphur in the infected apartment for the purpose of destroying the microörganisms of disease; but this measure is not any more efficient than a thorough scrubbing of the wood-work with hot water and soap, followed by the application of paint or whitewash to the walls and ceilings. Mattresses, pillows, and articles that cannot be thoroughly washed should be exposed for several hours to the action of heated air in a disinfecting stove, in which the temperature of 250° F., or more, can be steadily maintained.

For disinfecting and deodorizing purposes the sulphate of iron, one pound in a gallon of water, for use where it will not come in contact with clothing; chlorinated lime, six ounces to a gallon of water; milk of lime, prepared by adding one part of the hydrate of lime to eight parts of water; and carbolic acid in a five per cent. solution of the pure acid, are the safest articles for use among the common people. Corrosive sublimate and other disinfectants and antiseptics are only to be used under the direct supervision of the attending physician.

In dealing with infective diseases like cholera, yellow fever, small-pox, etc., which are not endemic, but are liable to importation from foreign countries, an efficient quarantine service is necessary at every port of entry. Here, again, the exigencies of commerce have brought to light the efficacy of thorough disinfection in dealing with yellow fever and cholera. In countries where the old-fashioned faith in quarantine, sanitary cordons, and isolation still prevail, but little success is obtained in the attempt to exclude these foreign pestilences, while the principal commercial nations of the world, Great Britain, Holland, and America, have reached the most gratifying results by reliance upon disinfection. By efficient inspection of passengers and cargoes, the existence of contagion may be ascertained, and the necessary measures of disinfection can be completed within the space of a few hours, where days and weeks were formerly required, too often without satisfactory results. Detaining only the sick for treatment in quarantine hospitals, travellers without disease may be safely permitted to pursue their course while only their clothing and other effects are subjected to disinfection by heated air, or by washing with boiling water and disinfectant solutions. The sanitary control of endemic infective diseases requires the most careful and delicate management on the part of officials intrusted with the care of the public health. In every considerable community, a health officer is a public necessity, but it should be never forgotten that

if insufficiently equipped with material and intellectual resourc
health office can easily become a nuisance instead of a benefit
community. In no position is there greater need of knowledge
and tact than at the head of a municipal department of health, f
necessary to deal with all classes of people, under the most tryin
ations in life. Whenever possible, the office should be filled
experienced physician, who, however, is not engaged in the prac
medicine. The exactions of an enormous foreign commerce
stimulated the leading nations of the world to the adoption
latest and best fruits of scientific investigation in the matter of q
tine; but unfortunately no such pressure is brought to bear
domestic sanitarians. Consequently, in the matter of dealing
endemic diseases, very little progress has been made since th
when attempts were made to arrest the progress of the plague by
placards upon the doors of infected houses, and locking up their i
to die without assistance.

In the endeavor to arrest the spread of infective disease th
thing that is needful is to secure early information regarding th
tion and character of such diseases as are placed under the supe
of the municipal officials. For this purpose it is desirable to en
aid of every physician; but, since it is obviously improper for a
cian to furnish information regarding a patient which that patie
his friends are not required to furnish, the regulations of the
department should require notification in case of infective dise
the nearest friend or relative of the patient. For such notifica
compensation need be rendered, since such notification is a duty
bent alike upon all under similar circumstances; it is a service re
by the patient himself for himself. Since, however, such repor
unprofessional people can be obtained only with difficulty, if at
principal reliance should be placed upon notification by the att
physician, who should in every instance be paid by the mu
authorities a stipulated sum for each notification, just as he sh
paid for every professional service rendered either to the pu
to his private clients.

Having obtained information regarding the existence of in
disease, the health officer should proceed to verify the fact by
ference, either in person or by deputy, with the attending phy
The same professional rules that govern ordinary consultations
be observed in this matter, otherwise friction will inevitabl
between the attending physician and the health officials. All c
nications from physicians to the health officer regarding disease
be of a confidential character, and should never be open to ins
by the public. If this rule be not observed, that freedom of c
nication between the central authority and medical practitioners
is so desirable will cease to exist, for the mass of physicians w
tolerate the publication of details regarding their practice whic
come under the eye of a sanitary inspector.

In dealing with the different infective diseases that are ende
that may become epidemic, different methods are necessary. *Sm*
can be readily eradicated by universal vaccination, consequent

incipal effort of the sanitary authorities should be directed to the complishment of this end. In communities where public schools are aintained, it is sufficient to require a certificate of vaccination from very child on admission to school. In this way the same result is directly reached, without objection on the part of the public, which otherwise can be only obtained with great difficulty and much dissatisfaction when compulsory infant vaccination is demanded by law. It is impossible in any considerable population to deal properly with smallpox unless sufficient hospital accommodation for variolous patients can be provided. The smallpox hospital should be as far from other habitations as possible without rendering a journey thither dangerous to the sick during severe winter weather, for patients should not be transported far from their homes during the inclement season of the year. Only during the interval between the invasive fever and the commencement of suppuration can such exposure be safely tolerated in severe forms of the disease. When removal is impracticable, it is sufficient to isolate the sufferer in his own home, affording protection to others by vaccination and re-vaccination of everyone in the neighborhood of the infected house.

Cholera patients can be safely treated in their own homes, provided sufficient provision can be made for their care. The principal effort of the sanitary official should be directed to the disinfection of the premises, clothing, bedding, etc., that have been soiled. The most efficient method of dealing with an epidemic of cholera consists in visitation from house to house by a properly appointed corps of visitors, whose duty it is to distribute circulars containing information regarding the disease, and to administer the approved remedies to all persons whom they may find suffering with diarrhœa. In many cases certain religious orders have furnished most valuable aid in such house to house visitation; and in severe epidemics of the disease such assistance is indispensable.

An epidemic of *yellow fever* requires similar management, but it is desirable to disperse the population upon whom the disease is incident. The population of a plague-stricken community should be encouraged to leave their homes, and to seek a non-infected locality, even if it be only a short distance outside of the town or city in which the epidemic prevails. Thorough disinfection will accomplish all that can be effected until the return of cold weather destroys contagion.

Typhus fever and *relapsing fever* are diseases that require for their extermination little besides good feeding, thorough ventilation, and efficient disinfection. The sick should be taken out of their filthy dens, and be placed under canvas, or in airy wooden pavilions during the inclement season of the year. Only when left to herd together in filth and poverty, or when overcrowded in almshouses, barracks, and unventilated hospitals, does the disease become dangerous to a well-fed American community.

In the attempt to deal with infective diseases no inflexible rules or municipal statutes should be laid down for the guidance of the health office, excepting those general provisions that are needful to place executive authority in the hands of the health officer. The fact should be recognized that our methods of dealing with epidemic disease are

still in the experimental stage, and there should be opportunity for continual experiment and innovation in the attempt to control such diseases. Nothing can be more unfortunate than a routine method on the part of sanitary officials. The tendency in this direction is at the best too strong in all municipal corporations, and it should be resisted to the utmost. This tendency to fall into a rut is especially liable to occur in connection with the endemic diseases of a community, since in a large city the ordinary occurrence of such disorders is not very conspicuous, and at the same time they are too commonplace to arouse anything more than a languid interest in the minds of the public and of the medical profession. The sufferers themselves who are benefited or damaged, as the case may be, by the treatment that they receive at the hands of the officials, are usually voiceless, and their praise or their protests pass unheeded. It is for this reason that, except in a few favored localities, the efforts that are made for the improvement of the public health are often most unwisely conceived and inefficiently executed. Habitual abuses remain for years unchecked, without the slightest attempt for their removal, until they become crystallized and sanctioned by antiquity.

It is impossible for any health officer, however skilled or well-disposed, to cope with endemic disease in a large city unless he has at his command the resources of a well-equipped hospital provided for the special reception of such diseases. Without such a hospital he is one of the most helpless and useless persons in the community. In every large city more than one such hospital is needed, so that the buildings may be easily accessible from all parts of the town. In small cities and in country districts, something after the plan of the English Cottage Hospitals will be sufficient. These hospitals, however, should not be used for any but the needy members of the population, who cannot procure attendance and sufficient isolation in their own homes. Having received notification of the existence of infective disease in a particular house, the health officer should ascertain whether such attendance and isolation can be secured by the patient; if that be the case, further interference on his part is unnecessary, unless it be for the purpose of distributing information to the inhabitants of the infected house, and securing sufficient disinfection of the premises after the conclusion of illness. But if the poverty of the patient render it impossible to secure necessary attendance, isolation, and disinfection, as when, for example, he is a poor laborer living in a cheap boarding-house, or when the family of the sufferer occupy quarters in connection with their place of business, so that they cannot continue their daily avocations without exposing customers and strangers to infection, the patient should be removed to the hospital. If it be needful for the safety of the public thus to remove little children, the mother or other near relative should be permitted to accompany the child, and to remain with it during its treatment in the hospital. In this way many prejudices can be easily overcome.

In belated communities that are still under the influence of mediæval notions, great efficacy is ascribed to the practice of placing placards upon infected houses. It is true that by this method the largest pos-

lisplay of official authority is secured with the smallest expendi-
f useful energy; but the practice is objectionable for several
s. It is thoroughly repugnant to the feelings and prejudices of
ajority of people; it is an occasion of great alarm and anxiety
e part of unintelligent neighbors; and is usually a signal for de-
n of the afflicted family by the servants whom they may have
yed in the house. Worst of all, it prevents many persons from
wledging the existence of infective disease in their houses, and
ealth official thus remains frequently ignorant of the extent to
certain diseases are prevalent; for, however much the fact may
nied, it still remains true that the concealment of infective dis-
s a very common incident in large cities where placards are used.
is respect human nature remains unchanged since the days of the
plague in London, when people tore down the placards that were
upon their houses, and could be only restrained by an army of
al police. Similar scenes were enacted in Philadelphia when an
ipt was made to placard houses during the great epidemic of yellow
in the days of the famous Dr. Rush. The terrified population
ted the attempt, would have nothing to do with physicians or
h officers, who were consequently obliged to stand paralyzed until
ffensive enactment was withdrawn. In small rural communities,
e the majority of families are independently comfortable and
ient unto themselves, a placard works little inconvenience, and
be tolerated; but in a crowded city population, where such notices
mean the destruction of a poor man's business and starvation for
inmates of a quarantined residence, continual evasion of the law
occur. The use of placards, therefore, should be discretionary
ad of compulsory, and they should be displayed only when in-
ient isolation of a patient cannot be secured in his home. It is
this reason that in every municipality special hospitals are so
ssary, in order to make provision for patients who cannot be with
y to the population left in their own homes. It should be never
tten that the public has no right to destroy the business of any-
without full compensation for the time and property that have
rendered useless in the effort to protect the public health. Such
ess interference with the rights of poor people frequently occurs
gh the indiscriminate use of placards; all of which might be
ed by removing the infective patient to the proper hospital.

nother weighty objection to the indiscriminate use of placards con-
in the fact that where they are employed, they become the principal
ice of the sanitary officials, who, having nailed a warning card
an infected house, subside into a state of utter indifference regard-
ny other duties than the preservation of their sign-manual for a
number of days. Medical attendants, infected families, and all
es concerned, insensibly fall into the habit of reliance upon this
es of quarantine, and the proper measures for disinfection are
cted. A certain feeling of resentment also grows up in the hearts
e sufferers, and they become indifferent to the communication of
gion among their neighbors. Little by little this feeling of neg-
ce involves the uninstructed masses; from the extreme of panic

they pass to the extreme of carelessness, and the warning placards are finally regarded with the same indifference with which ordinary posters are read.

Public funerals after death from the virulent infective diseases should not be allowed.

In many localities it is customary to exclude from the public schools children who belong to infected families, even though they be themselves free from disease. This regulation, however, is useless, since those children, if not in school, will be generally found upon the streets mingling freely with their playmates. To attempt their confinement within their infected homes would only subject them to greater danger of infection, and would also intensify the virulence of the disease when experienced. Children who are ill should be, of course, excluded from the schools until they can produce a medical certificate of complete recovery; but while the great object of isolation should be the separation of the sick from the well, it should not be carried so far as to include the well within the limits of quarantine. Every attempt to enforce rigid quarantine among the masses of a large city in the case of ordinary endemic diseases, produces hardships and evils that are worse than those which are caused by disease itself.

The attempt to suppress the extension of *syphilis* has been often undertaken by sanitary officials in many of the large cities of the world, but it has always resulted in signal failure. It is true that in semi-barbarous and partly isolated communities, where men and women are treated like animals, and can be subjected to military discipline and despotic rule, a certain degree of success can be secured by frequent inspection and treatment of prostitutes; but this result is obtained at the cost of much that is invaluable in a free, enlightened, and moral community. For these reasons it is now acknowledged by the leaders of social science that syphilis can be most effectually controlled by those indirect methods that elevate the character and welfare of the population. Prosperity, education, and moral progress are more efficient barriers to the spread of syphilis than any that can be provided by the ordinary guardians of municipal health.

The recent demonstration of the infective character of *tuberculosis* has in certain quarters been followed by the agitation of propositions for the compulsory suppression of tubercular disease. In this case, however, as in many others, a knowledge of the history of tuberculosis during past ages would preserve many well-meaning sanitarians from useless and annoying endeavors to accomplish that which can be only effected indirectly through the gradual progress of the population in wealth, civilization, and comfort. For many years pulmonary consumption was in Southern Europe considered a highly infective disease. In the city of Naples physicians were required to report to the health officer every case that came under their observation, under penalty of an enormous fine and banishment for ten years. The patient was ostracized like a leper, was excluded from employment, and his family were reduced to beggary. After death the rooms that he had inhabited were completely eviscerated and thoroughly rebuilt; yet despite all this ferocious violence, consumption continued its ravages, and the

ı rate from that cause was higher than in other cities, thus fur-
ng an excellent illustration of the utter futility of every attempt to
ress endemic disease by methods that do not substantially improve
ıabits and welfare of the population. In this connection it should
ıways remembered that, unless some radical improvement be
ted in the habitations, provisions, occupations, and character of
population, no great change in the general mortality can be pro-
d by mere sanitary rules and regulations. The suppression of
llpox has been followed by an increased mortality from scarlatina;
ıuppression of scarlatina and measles has been followed by an in-
sed mortality from diphtheria, typhoid fever, and diarrhœa. The
ervation of infant lives has for its principal result an increased
tality in early and middle adult life, at the time when existence is
:test and most valuable. Consequently it is not worth while to
npt the improvement of public health by methods that are arbitrary,
ınt, and repugnant to the feelings and prejudices of the commu-
. Indirect methods that improve the hygienic environment, pros-
:y, and comfort of mankind alone give an abiding and satisfactory
lt.

PART III.

ISEASES OF THE ALIMENTARY CANAL.

CHAPTER I.

DISEASES OF THE MOUTH.

Catarrhal Inflammation of the Mouth—Stomatitis Catarrhalis.

ETIOLOGY. *Stomatitis* is generally caused by irritants of a thermal, hanical, or chemical character. *Extremely hot* or *cold articles* of or drink, or excessively heated air, may excite inflammation of the th. Among *mechanical irritants* may be enumerated the forcible usion of sharp and angular, or ragged bodies. In like manner, ken teeth, and projecting particles of tartar may excite inflamma-. It occurs, sometimes, among very young infants as a consequence xcessive efforts in the act of nursing, or as a consequence of improper l. Violent screaming and shouting may cause inflammation by ension from the larynx to the pharynx.

Among *chemical causes* may be mentioned the excessive or improper of certain drugs—*e.g.*, iodine, bromine, arsenic, lead, mercury, ate of silver, mineral acids, caustics, irritating gases, alcohol, and cco. The regurgitation or vomiting of acid liquids from the stom- and the decomposition of particles of food which have lingered in mouth, may also occasion inflammation. It frequently accompanies ral ill-health, such as may be produced by chlorosis, anæmia, and vy, or by chronic diseases of the heart and lungs, which interfere the circulation of the blood, and by infective diseases. It often mpanies the processes of dentition.

ATHOLOGICAL ANATOMY AND SYMPTOMS. *Acute catarrhal inflam- on of the mouth* commences with sensations of heat and dryness in ral cavity. The mucous membrane is painful on pressure. Its tions are diminished; though, at a later period, they may be so gerated that the saliva flows over the lower lip and produces ery- a upon the chin. The reaction of the saliva is usually acid. The s of taste and smell become perverted; there is complaint of a taste in the mouth; and the breath exhales a disagreeable odor, nsequence of decomposition of the products of exudation. The ned mucous membrane appears excessively reddened and swelled. tongue appears broader than is natural, and its borders are

indented by the teeth. The inner surfaces of the cheeks are similarly indented. Sometimes the follicular glands of the mouth are inflamed, and project in the form of little warty prominences which, on pressure, yield a small quantity of puriform liquid. Their rupture is not unfrequently followed by the formation of small ulcers. The epithelial cells of the mucous membrane are exfoliated in considerable quantity, producing a more or less thick coating upon the tongue and other mucous surfaces. Sometimes the fungiform papillæ of the tongue appear above the epithelial layer in the form of red and tumefied prominences about the size of a small pinhead.

The general symptoms are usually moderate, except in very young children, who sometimes exhibit the phenomena of high fever or convulsions. The duration of the disease rarely exceeds one week, though chronic catarrh may linger with a moderate degree of intensity for a long period of time.

DIAGNOSIS AND PROGNOSIS. The *diagnosis* of catarrhal inflammation of the mouth is not attended with any difficulty if one keeps in mind the fact that something more than mere coating of the tongue is necessary to constitute the inflammatory process. Newly born children always manifest during the first days of life an increased redness of the oral cavity, which is occasioned by purely physiological processes dependent upon the first use of the mouth.

The *prognosis* in acute cases is always favorable. Chronic cases which are dependent upon errors of diet, smoking, drinking, etc., usually linger so long as their causes are operative.

TREATMENT. In addition to the discovery and removal of the exciting cause of catarrhal inflammation, it is only necessary to employ frequent gargling of the mouth with cold water and with a 2.5 per cent. solution of chlorate of potassium every two hours. Young children who cannot gargle may have their mouths syringed with the solution. Other excellent gargles are salicylate of sodium (2 per cent.), carbolic acid (2 per cent), permanganate of potassium (a teaspoonful of a 1 per cent. solution in a glassful of water), liquor aluminii acetici (a teaspoonful of a 5 per cent. solution in a glass of water). Chronic inflammation may be successfully treated by daily applications of a solution of corrosive sublimate (0.001 per cent.), or of nitrate of silver (1 per cent.).

Ulceration of the Mouth—Stomatitis Ulcerosa.

ETIOLOGY. The principal indications of this disorder are severe ulceration of the gums attended by an extremely offensive breath. The disease sometimes occurs epidemically among the poor, and in ill-managed institutions where large numbers of feeble children are crowded together without proper care. Among adults it is most frequently encountered among weakly individuals who are the victims of cachexia. It usually occurs during the period of dentition.

A special form of ulceration of the mouth sometimes follows the excessive use of mercury. Lead, phosphorus, and copper, occasionally produce a similar form of the disease.

Pathological Anatomy and Symptoms. The disease commences ith a sensation of heat and soreness in the mouth, which is increased taking food. The inflammatory process arises usually between two jacent teeth, along the free border of the gum on the lower jaw. he mucous membrane swells, and bleeds freely upon the slightest uch. In the course of one or two days the process of ulceration is mplete, and upon the gum appears an ulcer with a dirty-gray surface, hich is made up of detached epithelial cells, pus corpuscles, blood, cteria, and detritus. The ulcerative process gradually extends to e inner margin of the gums, and may involve the opposite surface of e tongue or of the lips and cheeks. The sockets of the teeth are so invaded, so that the teeth become loosened and fall out, or may be moved without pain. The jawbone itself may become inflamed and crosed. The odor of the breath is horribly offensive. The adjacent mph glands become enlarged and tender. The salivary glands yield opious, acid, sometimes bloody and offensive, saliva. There is often siderable fever accompanied by symptoms of general infection, but local processes are restricted to the mouth and its dependencies. ere is often great exhaustion as a consequence of the difficulties ch attend deglutition, together with loss of appetite and power of stion. In acute cases the disease runs its course in about two ks, but the chronic form continues for several months.

Mercurial stomatitis does not essentially differ from the ordinary m of the disease. It is often ushered in by a metallic taste in the uth, and a feeling as if the teeth were loosened in their sockets.

Diagnosis and Prognosis. The *prognosis* is almost always favor-, and the *diagnosis* is equally easy.

Treatment. The mouth should be thoroughly gargled, every two rs, with a 2 5 per cent. solution of chlorate of potassium. Liquid l, stimulants, and tonics (Elixir calisayæ, half an ounce, three times ay) should be given until the health is restored.

Stomatitis Aphthosa.

Etiology. This disease is chiefly encountered among young chil-n, especially during the period of dentition. It occurs frequently ong feeble children and cachectic persons, especially if they suffer h other disorders of the mouth and throat. It is often observed in nection with infective diseases, and with disorders of the alimentary al. It occurs sometimes among women as a consequence of uterine urbances, and during pregnancy or the period of lactation. Some-es the disease manifests an epidemic prevalence in certain localities, ecially during warm or unsettled weather. It is probable that thous eruptions are of an infective origin, since the pyogenic phylococci and numerous other bacteria exist in the inflammatory ducts.

Pathological Anatomy and Symptoms. The characteristic ap-rances in *aphthous sore mouth* consist in the development of round ite flakes which appear upon the mucous membrane, and are sur-nded by a red ring of injected bloodvessels. These deposits may

be very minute, or they may reach the size of a split-pea. Sometimes the coalescence of several patches produces an irregular area of considerable size. If a tooth is cutting its way through the gum, an aphthous deposit is formed at the point of eruption. In other cases it occurs along the borders and tip of the tongue, upon its under surface, and along the fold between the lips and the gums. Aphthæ may appear upon the roof of the mouth, about the uvula, and upon the tonsils, where they must not be mistaken for a diphtheritic membrane.

Since aphthæ frequently appear in successive crops, it is easy to trace their development. They are never vesicular, nor do they contain any accumulation of liquid. The aphthous flake consists of granular fibrin which contains a few embryonic cells entangled in its meshes. The exudations appear to be excited by the action of certain microörganisms which produce coagulative necrosis of the superficial epithelium, with subsequent exudation of fibrin and round cells. The exudation does not penetrate deeply into the mucous membrane, but seems to involve the superficial layer exclusively. The process of recovery is preceded by the exfoliation and discharge of the products of exudation, which leave behind an ulcerated surface that undergoes the process of cicatrization, and is usually healed in the course of ten days or two weeks.

The disease is attended by no special danger, though nurslings frequently experience pain in taking the breast, and suffer in consequence from the effects of imperfect nutrition.

Sometimes the orifices of the salivary ducts become obstructed by the development of aphthæ, so that the glands become swelled and painful through retention of their contents. Immediate relief follows the introduction of a fine probe into the obstructed passage.

Diagnosis. Apthæ must be distinguished from (1) *patches of coagulated milk* which adhere to the mucous membrane, but are not surrounded by the reddened areola that characterizes an aphthous deposit; (2) from *ulcerative stomatitis*, which is recognized by the occurrence of offensive breath, and by a tendency to hemorrhage from the ulcerated surfaces; and (3) from *herpes* and *thrush*, which are characterized by the eruption of vesicles that contain a perceptible quantity of fluid. Thrush may also be diagnosticated by the discovery of its peculiar parasite.

Treatment. The local use of a 2.5 per cent. solution of chlorate of potassium every two hours is all that is needed.

Leucoplacia Oris.

Pathological Anatomy. *Leucoplacia oris* is characterized by the appearance of light-gray or yellowish patches, usually upon the tongue, though sometimes upon the mucous membrane in any other part of the mouth. The patches are irregular, sometimes slightly elevated at their margins, and occasionally present a moderately indurated surface. They consist of epithelial cells, which are softened and swelled, and are heaped upon one another in an irregular fashion. The papillæ of the

mucous membrane appear flattened, and the sub-epithelial layers are infiltrated with round cells.

Symptoms, Diagnosis, and Prognosis. The symptoms are, for the most part, such as address themselves directly to the eye. Sometimes there is a sensation of heat and tenderness in the affected parts. Gastric derangement is not uncommon. The disease may be readily differentiated from other oral disorders by the history of the case, and by microscopical examination of the exudation.

Etiology. Leucoplacia is caused by irritation of the mucous membrane, arising from the use of tobacco and alcohol, or from the irritation produced by decayed teeth, or as a result of disordered digestion, gout, and syphilis. It is, sometimes, associated with certain cutaneous disorders; *e.g.*, psoriasis, lichen, eczema, ichthyosis, and epithelioma. It is more frequently observed among men than among women, especially during the period of active adult life.

Treatment. Treatment must consist largely in the regulation of the habits and diet of the patient. For internal medication may be recommended arsenic (liquor potass. arsenit., 3 to 5 drops three times a day). The caustic application of chromic acid (a 20 per cent. solution every three or four days) has been recommended. Galvano-cauterization has also given favorable results. Nitrate of silver, tincture of iodine, and corrosive sublimate have been locally applied. The use of iodide of potassium is attended with considerable relief from suffering, and the pain of cauterization may be greatly alleviated by the local application of cocaine.

Thrush—Stomatomycosis Oïdica.

The occurrence of thrush upon the mucous membrane of the mouth is dependent upon the growth of a parasite, *oïdium albicans*. The disease usually occurs among children during the first few weeks of life,

Fig. 88.



Oïdium albicans, the vegetable parasite of muguet or thrush. (Reduced from Ch. Robin.)

or in older patients who are the victims of other exhausting diseases. It is not uncommon among neglected infants who suffer from the want of proper nourishment and care. Artificially nourished children, who

take their food from bottles that are imperfectly cleansed, are exceedingly liable to the disease. It may also be conveyed to the mouth of a healthy child by nursing at the breast of a mother who had previously given suck to a diseased infant. The nipple may itself become the seat of the parasitic growth, by which nurslings may become infected.

SYMPTOMS. *Thrush* appears in the form of a thick, white layer upon the mucous membrane, and may be frequently discovered between the fungiform papillæ, or in the neighborhood of the follicular glands of the mouth. These deposits gradually increase in size and thickness, and develop a gray, yellow, or brown color as the patches extend and become confluent. The exudation cannot be wiped off from the mucous surface, because it is beneath the superficial layer of epithelium. At a later period the epithelium gives way, and the products of exudation may then be removed, leaving behind a roughened surface. Microscopical examination discovers the presence of a great quantity of parasitic filaments and spores which are mixed with epithelial and embryonic cells.

Thrush is by no means limited to the mucous membrane of the mouth. It may occupy any portion of the oral cavity, and it sometimes exists in the pharynx, in the œsophagus, in the respiratory passages, and in the alimentary canal.

The duration of the disease is not uniformly defined. Recovery usually takes place in the course of ten days or two weeks.

The development of thrush is frequently associated with an inflammation of the mucous membrane that occasions pain, and prevents nurslings from taking the breast. Sometimes they are also attacked by severe diarrhœa in consequence of fermentation and decomposition in the alimentary canal.

PATHOLOGICAL ANATOMY. The principal feature in the development of thrush consists in the invasion of the middle layers of the mucous membrane by a parasitic growth that causes atrophy of the invaded tissues. Sometimes the submucous tissue and the vascular structures are also invaded by the parasite.

DIAGNOSIS AND PROGNOSIS. Microscopical examination renders the diagnosis easy. The disease may be differentiated from *aphthæ* by the absence of the areola which forms around the aphthous patch. *Spots of coagulated milk* resemble thrush in their superficial appearance, but the characteristic parasite is absent. The development of *sarcinæ* in the mouth may also be distinguished from thrush by the presence of the characteristic parasite. The prognosis is not always favorable, since the disease frequently occurs in association with other dangerous diseases.

TREATMENT. Young children should always, after taking nourishment, have their mouths cleansed with a soft piece of linen that has been dipped in water. Nursing-bottles should be carefully washed and kept in a dish of salt water, when not in use. The nipple of the nurse should always be cleansed after each application of the child to the breast. The local treatment consists in the use of a 2.5 per cent. solution of boric acid, every two hours. Young children who cannot rinse their own mouths may be treated by swabbing the mucous membrane

th a soft piece of linen dipped in the solution, or, if they be very stinate, the fluid may be thrown into the mouth with the aid of a all syringe.

Oral Parasites.

The number of parasitic organisms which may exist in the mouth is ry large; not far from one hundred different species and varieties ve been discovered. Of these, a form identical with the pneumococcus usually present. When the saliva in which it is contained is injected to the small animals of the laboratory, a fatal result is produced, with mptoms of septicæmia. Sarcina, Leptothrix buccalis, and various her microörganisms, are sometimes found in the mouth, where they doubtedly excite numerous chronic, minor disorders. The well-own relation between parasitic microörganisms and the decay of the eth is fully discussed in the writings of dental authors.

CHAPTER II.

DISEASES OF THE SALIVARY GLANDS.

Salivation—Ptyalismus.

SALIVATION is a term that indicates increase of the salivary secretion, hich sometimes reaches a quantity sufficient to overflow the lips, causing reat inconvenience to the patient. It is sometimes difficult to decide hether the amount of saliva is actually increased, or whether the echanism for its retention and deglutition are defective, since the ormal quantity varies within very wide limits.

Increase of the salivary secretion is usually excited by reflex irrita-on of the salivary glands. This may happen in connection with flammatory diseases of the mouth, or as a consequence of the use of rugs which excite secretion, *e. g.*, mercury, iodine, gold, silver, copper, ad, arsenic, jaborandi, physostigmine, nicotine, and digitalis. Spices, bacco, and other substances that possess an irritant, acid, or acrid haracter, operate in the same way. Neuralgic affections of the cranial erves, and excitation of the special senses, frequently react upon the alivary glands. In like manner diseases of the digestive organs, and exual excitement, are frequently accompanied by salivation. Nervous nd excitable persons frequently experience similar results as a con-sequence of cerebral exaltation or depression. Diseases of the medulla blongata and pons Varolii are especially liable to be accompanied by profuse salivation. A considerable flow of saliva is sometimes observed n connection with certain infective diseases, especially at the period of risis, when other secretions are exalted.

SYMPTOMS. Sometimes the patient experiences a sensation as if water were flowing into his mouth. This is caused by the rapid afflux of saliva into the oral cavity. In certain cases a sensation of tenderness and distention is experienced in the glands themselves. The patient must swallow frequently, or is obliged to expectorate the contents of his mouth, in order to avoid interruption during the act of articulation. The quantity may sometimes reach ten or twelve quarts in the course of twenty-four hours. The reaction of the fluid is variable, sometimes alkaline and sometimes acid. Ptyalin and sulphocyanide of potassium are frequently absent.

Sleep is frequently disturbed by the copious discharge of saliva which saturates the pillow, or suffocates the patient, if it passes backward into the pharynx and larynx. The chin is erythematous from the constant overflow, and the stomach also becomes disordered in the same way. Not unfrequently the evidences of catarrhal inflammation of the stomach exist, especially among drunkards who vomit large quantities of saliva on arising in the morning. The renal secretion is also sometimes greatly increased.

Transient cases speedily recover; but, in chronic cases, the patient gradually sinks into a cachectic condition, and, after a more or less protracted illness, dies from exhaustion, which is the result of the underlying disease by which profuse salivation was maintained.

DIAGNOSIS AND PROGNOSIS. Since salivation is only a symptom, one should never remain content with anything less than a diagnosis of the remote causes of the disorder, for upon their nature and curability will depend the prognosis.

TREATMENT. If the cause of salivation can be removed, the symptom speedily disappears, but in cases of central origin or of a persistent nature, great relief may be obtained by the use of atropine, in doses of $\frac{1}{120}$ of a grain, two or three times a day. The drug may be used hypodermically with advantage. Opium has been given in small doses, $\frac{1}{4}$ of a grain every two hours, with temporary benefit; but the risk of acquiring the opium habit must not be forgotten. The salivation of pregnancy is, sometimes, speedily relieved by the administration of iodide of potassium in 5 to 10 grain doses, three times a day.

Diminution of the Salivary Secretion frequently results after the administration of atropine. It sometimes occurs during fright or mental excitement. Fever is generally attended with reduction of the secretion, and it forms one of the most disagreeable symptoms of diabetes and other diseases which are attended by an unusual discharge of urine. In all such cases, the remote cause must be ascertained in order to secure accurate indications for treatment. Distressing dryness of the mouth and tongue, such as may be frequently observed during the course of dangerous fevers, must be relieved by frequent cleansing of the mouth, the use of cooling drinks, and the application of vaseline to the lips and tongue. Sometimes advantage may be derived from the administration of pilocarpine or mercurials.

Fibrinous Inflammation of the Salivary Ducts—Sialodochitis Fibrinosa.

nflammation and obstruction of the salivary ducts with a fibrinous lation has been occasionally observed. The salivary passages me distended and the glands are swelled and painful. The symp- s are readily relieved by catheterization of the ducts, an operation h is followed by the escape of a purulent liquid that sometimes ains fibrinous plugs and parasitic microörganisms. Sometimes the ages become obstructed by the presence of calcareous masses (sali- calculi).

CHAPTER III.

DISEASES OF THE FAUCES AND PHARYNX.

e Catarrhal Inflammation of the Fauces and Pharynx—Angina et Pharyngitis Catarrhalis Acuta.

TIOLOGY. *Acute pharyngeal catarrh* is generally indicated by ful sensations that accompany the act of deglutition, as if the es were constricted. Hence the name Angina or Cynanche, which ifies constriction. The sensation is caused by a hyperæsthetic lition of the inflamed mucous membrane, which, moreover, is some- t impeded in its functions by the inflammatory infiltration that has n place. The inflammation may be circumscribed, or it may in- e all of the soft parts of the fauces and pharyngeal cavity.

Rheumatic angina occurs as a consequence of exposure to cold n the system is predisposed to rheumatism. Since that disease is endent upon a peculiar infection, the effect of cold must be con- red as a predisposing cause for the invasion of the tissues by the ctive agent. The particular parasite which constitutes the exciting e of the disease has not been identified, but the general symptoms the frequently epidemic appearance of the disease argue in favor parasitic origin.

Rheumatic angina is very common among children, especially if they delicately organized, and belong to families in which a predispo- n exists.

Traumatic angina is usually caused by the passage of sharp and irri- g bodies into the pharynx. Inhalation of a dusty atmosphere, and se of the voice, are very liable to excite a chronic inflammation. nay also be excited in an acute form by swallowing hot or cold ks, or by the inhalation of excessively heated air or irritating gases. ds, alkalies, caustics, and various irritating drugs excite severe mmation if allowed to enter the mouth and throat.

Infective diseases, especially the exanthemata and syphilis, are fre- ntly accompanied by angina.

Finally, inflammation may invade the fauces and pharynx by a process of extension from adjacent centres of inflammation, such as occur in catarrhal diseases of the air-passages and gastric mucous membrane.

Symptoms and Pathological Anatomy. Acute catarrhal inflammation of the fauces and pharynx frequently commences like other acute infective diseases. It is ushered in with chills and a high fever, which, among children, may be accompanied by convulsions. The patient complains of difficulty and pain in the act of deglutition. The fever subsides quite suddenly in the course of a few days, but there is considerable debility for a considerable time longer. There is often a notable disproportion between the general symptoms and the local inflammation; high fever may be associated with very slight visible change in the mucous surfaces. The spleen is frequently enlarged, and a herpetic eruption often appears about the mouth, as in other infective diseases.

The act of swallowing is attended with some degree of pain: yet the patient feels impelled to frequent efforts of that nature. The neck appears stiff, and the head is slightly inclined forward toward the side upon which the inflammation is most severe. Pain extends into the ear, and is felt behind the angle of the jaw. The voice is hoarse, and articulation becomes difficult and nasal, when the tonsils are enlarged. Sometimes the jaws become fixed so that the mouth cannot be opened without intense pain. The submaxillary lymph glands become enlarged and sensitive. The salivary glands secrete an excessive amount of saliva which is sometimes turbid, bloody, and offensive.

The intensity of the inflammation is variable, so that three forms of angina may be described: (1) *Superficial catarrhal inflammation* is characterized by redness and swelling of the mucous membranes. The color is sometimes uniformly diffused; sometimes it is patchy, and hemorrhagic points may become visible. In certain cases the injected surfaces exhibit a bright-red color; in others they are dark and purple. The amount of swelling is greatest when the submucous connective tissue is most loosely developed. For this reason, the uvula is frequently greatly tumefied and elongated, so that by its contact with the pharyngeal surfaces retching and vomiting may be excited. If the tonsils are invaded (angina tonsillaris), they may be so greatly enlarged as to touch one another. Secretion is, at first, diminished; but, at a later period, it is increased, and the inflamed surfaces are covered with a muco-purulent exudation. The mucous follicles frequently participate in the inflammatory swelling, and project above the mucous surface. Their rupture is followed by local erosion and ulceration. Sometimes the perverted and exaggerated follicular secretion accumulates upon the surface, and may be mistaken by inexperienced observers for a diphtheritic deposit.

(2) *Phlegmonous angina* is characterized by the extension of the inflammatory process to the submucous connective tissue, and by a predisposition to the occurrence of suppuration. It is ushered in with a very high fever, and the local swelling is greater than in the superficial variety of the disease. Suppuration leads to the formation of an abscess, which may break spontaneously, either into the oral cavity, or

nally through the tissues of the neck. Erosion of the carotid
and fatal hemorrhage have thus been produced; and cases are
ded in which pus has burrowed through the cervical connective
s into the thorax. Death has been known to occur as a conse-
ce of suffocation through obstruction of the air-passages after rup-
of an abscess. In other cases œdema of the glottis has been
loped, and has suddenly terminated life. Usually, however, the
nation of pus is followed by speedy relief and rapid recovery.

) *Lacunar inflammation* involves the tonsils alone. The tonsillar
næ undergo inflammation, and are distended with a puriform secre-
which becomes caseated, and sometimes calcified, forming an offen-
mass, varying from the size of a pinhead to that of a pea. It is
posed of oil globules, crystals of cholesterine and of the fatty acids,
ciated with embryonic cells and numerous microörganisms.

he duration of the disease as an acute inflammation occupies, ordi-
y, only a few days. The general symptoms are those of catarrhal
. Many of the brief febrile attacks which occur among children
lue to angina. The disease is liable to frequent relapses. The
ils frequently become permanently enlarged, so that the posterior
s are obstructed, and the patient is obliged to breathe through the
th. Sometimes respiration is thus very seriously impeded. Not
equently the Eustachian canal becomes involved in the inflammatory
ess, and otitis may result, with consequent deafness, noises in the
, etc. The symptoms of gastric catarrh are very often observed in
nection with pharyngeal inflammation.

IAGNOSIS AND PROGNOSIS. The principal thing to avoid in the
nosis of catarrhal angina is a confusion of its symptoms and visible
s with those which accompany *diphtheria*. The prognosis is very
rable, though the degeneration of the disease into a chronic form
be feared.

REATMENT. *Prophylactic treatment* is of great importance when
redisposition to angina exists. The patient should be warmly
sed, and, if possible, should reside in a dry and healthy locality
re the air is pure and free from irritating qualities. An open-air
with daily sponge-baths and plenty of friction with a flesh-brush,
portant.

he *medicinal treatment* of angina must be directed to the removal
s causes, and to the cure of the local disorder. Syphilitic and
rial or rheumatic cases require the specific treatment appropriate
ose diseases. For local treatment the inhalation of vapor charged
five per cent. of chlorate of potassium, alum, or chloride of
onium, is beneficial. Some recommend the insufflation of these
dies in the form of powder. An excellent gargle may be prepared
one drachm of tincture of capsicum to three ounces of water.
grains of salicylic acid, with an effervescing powder in a half-glass
ater, may be given every two hours with advantage, especially in
matic cases. Acute inflammation may sometimes be aborted by
g five grains of powdered gum guaiac with twenty grains of the
bonate of potassium in a half-glass of strong lemonade, every four
s. If high fever be present, antipyrine, acetanilide, or phenacetine

may be given as needed. If abscess form in the tonsils, it should be evacuated as early as possible.

Chronic Catarrh of the Fauces and Pharynx—Angina Pharyngitis Catarrhalis Chronica.

ETIOLOGY. *Chronic catarrh of the fauces and pharynx* may be either diffused or circumscribed. It usually occurs during the first fifteen or twenty years of active adult life. It is more frequent among men than among women, especially among those of a weakly and nervous organization.

The disease sometimes results from a previous acute attack, or it may be developed gradually in a chronic form. Under all circumstances it is dependent upon the same predisposing causes that lead to acute angina. It is, therefore, very common among professional people who are obliged to make excessive use of the voice, and among smokers and drunkards. It sometimes results as a consequence of circulatory obstruction in chronic heart and lung diseases. It may accompany chronic inflammation of the kidneys, syphilis, tuberculosis, gout, rheumatism, and malarial cachexia. It may also result through the extension of chronic inflammation from neighboring organs.

SYMPTOMS AND PATHOLOGICAL ANATOMY. A diffuse inflammation of the pharynx and fauces occasions a sensation of dryness and irritation in the throat, especially on waking in the morning. The voice loses its smoothness and ease of articulation. The worst forms of the disease occur among old drunkards, who find themselves obliged, on arising, to clear their throats of a very tough and adhesive mucus which can be discharged only with great difficulty, leading often to retching and vomiting.

The *tonsils* frequently become very much enlarged, so that articulation acquires a disagreeably nasal character. The patient is obliged to breathe with the mouth open, and children thus acquire a peculiarly stupid expression of countenance. Sleep is frequently disturbed by the difficulty of breathing that is thus produced. A certain amount of deafness, ringing in the ears, etc., frequently result from the implication of the Eustachian tube in the inflammatory process. The uvula becomes enlarged, and often trails upon the back of the tongue, causing nausea and retching.

In cases of chronic superficial catarrh the *mucous surface* is heightened in color, and often exhibits varicosity of the veins. The mucous secretion is increased, and is sometimes tinged with blood, so that its expectoration alarms the patient with the fear of impending consumption. During sleep the exudation frequently becomes dry, and can be removed only by distressing efforts through retching and hawking, or even by vomiting, in the morning. The pharyngeal wall is frequently studded with minute elevations that mark the seat of the inflamed mucous glands. The intervening surface is dry and shining, or covered with a tenacious, muco-purulent secretion.

Chronic parenchymatous catarrh is chiefly characterized by hyperplasia of the tonsils and uvula.

hronic lacunar catarrh is characterized by the presence of yellow, sive, caseated masses in the lacunæ and follicles of the tonsils. breath becomes exceedingly offensive; and patients are often med by the expulsion of the lacunar masses which they suppose e originated in the lungs, and are actually pulmonary tubercles. s error has often rendered the lives of uninstructed patients very erable.

The duration of the disease is usually coincident with the term of by reason of the persistency of the habits and other causes by ch it is perpetuated. Among children and among nervous people ometimes excites paroxysms of *laryngismus*, or of *asthma*, through ex influence.

TREATMENT. The local treatment of the superficial form of the ease is the same that has been recommended for simple catarrhal ctions of the oral mucous membrane. Benefit is sometimes derived m daily painting of the affected surface with tincture of iodine, or h a five per cent. solution of nitrate of silver, or with the glycerole tannin, or with a fifteen per cent. solution of the liquor ferri sesquioridi. The granular forms of pharyngitis are most successfully ated by galvano-cautery, which should be applied to each enlarged nd separately. Rheumatic cases are benefited by a residence at the rious sulphur springs. Relief in such cases may also be obtained m sulphur in small doses.

R.—Lac. sulphur.,	gr. v.
Potass. bitart.,	gr. j.
Sacch. lact.,	gr. x.—M.

S.—One such powder two or three times a day.

Chronic hypertrophy of the tonsils or uvula requires their removal surgical means.

Among other parasites, *Leptothrix buccalis* sometimes invades the nsils and the circumvalate papillæ of the tongue. It may be recogzed by the aid of the microscope, but for its extermination does not quire any special treatment different from the ordinary methods above scribed. The same parasite sometimes proliferates in the air-passages, in the œsophagus, where it may occasion considerable obstruction.

CHAPTER IV.

DISEASES OF THE ŒSOPHAGUS.

Constriction of the Œsophagus—Stenosis Œsophagi.

ETIOLOGY. The causes of œsophageal constriction are threefold: *Intra-œsophageal constriction* exists when foreign bodies have come impacted in the œsophagus in such a way as to diminish the

calibre of the passage. Strange as it may seem, the occurrence of this event has sometimes escaped recognition until examination of the body after death. *Pedunculated tumors* which project from the œsophageal wall sometimes produce constriction.

2. *Interstitial constriction of the œsophagus* exists when cancerous growths or cicatrized indurations have invaded the walls of the passage. Among these last may be mentioned the consequences of swallowing corrosive acids, or alkalies, or scalding water, or the occurrence of ulcers that are dependent upon syphilitic or diphtheritic processes. *Round ulcers*, similar to those which exist in the stomach, are sometimes found in the lower portion of the œsophagus, and by their cicatrization may occasion stenosis. *Abscesses* and *diverticula* in the œsophageal wall produce the symptoms of constriction, and it sometimes exists as a consequence of *congenital deficiency* in the development of the tube. *Spasmodic strictures of the œsophagus* sometimes occur as a consequence of temporary spasm in the muscular coat of the passage.

3. *Extra-œsophageal constriction* may result from the enlargement or displacement, or degeneration, or malignant transformation of any of the structures and organs that lie in the immediate vicinity of the œsophageal canal.

Pathological Anatomy. Constriction of the œsophagus occurs with increasing frequency as the stomach is approached. Multiple constrictions are rare. The strictured portion is sometimes very short; sometimes it occupies a considerable extent of the passage. The whole circumference of the tube may be invaded, or a limited portion only may be subjected to contraction. Above the point of stenosis the œsophagus is usually dilated, the muscular coat is hypertrophied, and the internal coat exhibits signs of catarrhal inflammation. Below the constriction the œsophageal walls are somewhat atrophied.

Symptoms. The principal symptom of stenosis consists in the evidence of difficulty in the act of deglutition. This is gradually developed, unless the cause of constriction has become suddenly operative, as when a foreign body becomes impacted in the passage. There is complaint of discomfort and obstruction in the act of swallowing, which may be localized at any point in the course of the œsophagus, though the sensation may afford no accurate indication of the precise situation of the constriction. Sometimes, especially in the case of a tight stricture, the act of swallowing food is followed by a sensation of suffocation, in consequence of compression of the respiratory passages by the distended œsophagus.

Food that has been swallowed is soon regurgitated. If the œsophagus has become pouched above the constriction, or if the point of stenosis is situated near the stomach, regurgitation may be delayed for some hours. Severe hiccough has been observed when the constriction was situated below the diaphragm.

As the disease progresses the patient finds himself compelled to restrict his diet to liquids. Finally, a sufficient supply of nutriment can be no longer swallowed, and emaciation and exhaustion inevitably lead to a fatal termination.

n order to ascertain the situation and amount of constriction, it is essary to resort to exploration with the aid of the œsophageal nd. For this purpose an olive-pointed bougie may be carefully roduced into the œsophagus, and gently passed downward until the t of obstruction is reached. In order to effect the introduction with e and safety, the physician should be assured that the sound will t break and that the point is firmly attached. Placing a large cork tween the back teeth of the patient, the tongue should be depressed th the fore- and middle-fingers of the left hand, while with the right nd the sound is cautiously introduced along the posterior wall of the arynx. Great disturbance often follows this proceeding, but, with a tle practice, a successful result may be reached. In very sensitive nditions the pharynx may be advantageously painted with a ten per nt. solution of cocaine before the operation is undertaken, or a scruple potassium bromide may be taken half an hour before the passage of e sound.

Auscultation of the œsophagus during the act of swallowing a liquid, metimes gives valuable information in the absence of a sound. The assage of the fluid through a narrow stricture causes gurgling sounds at are rendered audible by auscultation along the left side of the achea in the neck, and along the left side of the spinal column in the ack, as low as the eighth or ninth rib. A method of investigating he œsophagus by percussion has been proposed. For this purpose he patient is made to swallow a teaspoonful of the bicarbonate of odium in a small quantity of water, followed by a similar quantity of artaric acid. The effervescence that follows causes distention of that art of the œsophagus which lies above the stricture, and its limits ay be then determined by percussion. The discomfort that is expe-ienced by the patient during such an operation generally contra-indi-ates its employment.

Temporary improvement in the condition of a strictured œsophagus s sometimes observed when stenosis has been produced by cancerous rowths, or by adjacent glandular enlargements which are subject to ariation in size.

A fatal termination generally results from starvation after complete clusion of the œsophagus. Sometimes perforation of the œsophagus curs, by which a communication with neighboring cavities is effected, ith a subsequent fatal result.

PROGNOSIS. The prognosis is dependent upon the cause of œsophageal icture, and upon the rapidity of the constrictive processes.

TREATMENT. The treatment must be directed against the under-ng causes of stricture, and must also attempt the relief of the con-iction. The local treatment of the disease is fully discussed in the nuals of surgery. It consists chiefly in the attempt to effect a adual dilatation of the stricture by the daily introduction of bougies. r this purpose catgut sounds or dilators of laminaria may be intro-ced. These, through their expansion under the influence of moist-e, may be relied upon to produce a favorable result so long as the icture is permeable. Cancerous constrictions may be thus greatly ieved, since their softened tissues yield readily to pressure. The

relief of complete occlusion of the œsophagus has been attempted by the operation of gastrotomy, but the results are exceedingly unfavorable.

Œsophageal constriction sooner or later necessitates the alimentation of the patient through the rectum. When liquids can be no longer swallowed or introduced through an œsophageal catheter into the stomach, it becomes necessary to have recourse to nutritious injections. For this purpose peptonic preparations may be given in beef-tea, mixed with an equal quantity of milk, and thickened with a little starch. The fluid should be introduced, in a quantity not exceeding four ounces at a time, through the aid of a funnel and rectal tube, rather than by the use of a syringe, which is liable to irritate the bowel and to excite speedy evacuation of its contents. A most valuable form of nutriment may be prepared by mixing one part of tepid water with three parts of minced meat and one part of similarly prepared pancreas that has been freed from fat. In this way pancreatic digestion is secured and a fair degree of nourishment is accomplished.

Cancer of the Œsophagus—Carcinoma Œsophagi.

Pathological Anatomy. Œsophageal cancer is almost always of primary origin and epithelial character. It is generally situated in the lower third of the passage. Its favorite seats are immediately behind the cricoid cartilage or the left bronchus, and at the cardiac extremity of the œsophagus. It may develop as an isolated mass or it may embrace the whole circumference of the food-pipe. The œsophageal wall becomes considerably thickened and dilatation of the passage sometimes takes place above the point of stricture. The adjacent lymph glands become infiltrated with cancer, especially in the mediastinal space, and especially in the vicinity of the trachea and bronchi. The cancerous masses frequently break down and ulcerate, and thus a communication may be established between the œsophagus and any of the neighboring cavities. The disease, moreover, may propagate itself into any of the structures in its vicinity. Thus the vertebral canal and the thoracic viscera may be invaded, or the disease may be disseminated among still more distant organs.

Etiology. Œsophageal cancer occurs more frequently among men after the middle period of life. It may be directly excited by injuries or corrosion of the œsophagus, or by immoderate use of alcohol, and by chronic disease of the stomach.

Symptoms. The invasion of the œsophagus by a carcinomatous growth is very gradual. The occurrence of stenosis often affords the first symptom of the disease. This is frequently attended by great pain that is sometimes independent of the act of deglutition. It is generally referred to the lower portion of the passage, and may occur only during the night. Sometimes it extends along the intercostal spaces into the extremities. Frequently the recurrent nerves experience paralysis, so that the voice becomes affected. Laryngoscopic inspection readily reveals the paralytic condition of the laryngeal muscles.

When the upper portion of the œsophagus is the seat of a tumor, it

be sometimes detected by pressure in the neck. When situated down it is necessary to resort to the use of the œsophageal sound. is way particles of cancerous tissue may frequently be brought to The act of regurgitation also may bring up similar particles h possess great diagnostic value.

s the disease advances the principal symptoms are those of œsopha- constriction. The patient suffers with hunger and thirst, but the ach is in great measure deprived of its digestive function through absence of free hydrochloric acid from the gastric juice. The els are usually constipated, and the urine contains indican, which be readily discovered by the reaction of the urine with an equal ntity of hydrochloric acid and a few drops of a fresh solution of ochlorite of calcium, which develops a dark red or indigo color.

he average duration of œsophageal cancer is about thirteen months. tal termination results from starvation, or from hemorrhage, or from phageal perforation and subsequent intra-thoracic disease. Some- s the vertebral canal is penetrated, and paralysis follows. Not equently fever and pyæmia result from purulent absorption. In ain cases the symptoms of asthma or of angina pectoris may occur. ombosis and œdema are not uncommon.

ROGNOSIS AND TREATMENT. The prognosis is unfavorable. The tment consists principally in attention to the alimentation of the ent, and to the relief of pain with narcotic remedies. Daily intro- ion of the sound frequently postpones the occurrence of complete usion.

Dilatation of the Œsophagus.

Dilatation of the œsophagus may occur as a *primary congenital con- on* which involves either the whole length or a limited segment of passage. *Secondary dilatation* sometimes occurs when a stricture its in the course of the œsophagus. It has been observed occasion- after constriction of the pylorus. The muscular layer may present ious modifications of structure, or may be completely absent at par- lar points. The mucous surface of the œsophagus exhibits a con- on of chronic catarrh. The state of dilatation is attended with iculty in deglutition and with regurgitation of the food, which, on mination, appears macerated, and presents an alkaline or neutral ction instead of the acid reaction and evidences of partial digestion ch are apparent if the mass had previously reached the stomach. starchy constituents of the food are transformed into sugar by the on of the saliva that has been swallowed, and they exhale a sweetish , unless that is overpowered by the stench of putrefaction which uently exists.

econdary dilatation of the œsophagus is ordinarily masked by the l symptoms of œsophageal constriction.

Sacculation of the Œsophagus—Diverticulum Œsophagi.

Œsophageal diverticula exist under two forms:

Sacculation of the œsophagus (pulsion-diverticulum) is a rare rrence. It usually exists near the point of transition from the

pharynx into the œsophagus, and involves the posterior wall of the passage between the œsophagus and the spinal column. Large pouches frequently bulge out upon one side or the other of the larynx and trachea. Their dimensions may vary from the size of a small thimble to that of a pint flask. Their mucous lining is usually in a condition of chronic inflammation, and may exhibit multiple erosions. Sometimes the muscular layer is deficient.

The disease occurs most frequently among men after the middle period of life. It is possible that a congenital predisposition may exist in certain cases, occasioning a deficiency of muscular resistance in the œsophageal wall, and a consequent protrusion of the remaining layers. Senile changes may also favor the same result.

The symptoms of progressive sacculation of the œsophagus are gradually developed. Food and liquids enter and stagnate within the pouch, from which they can be frequently pressed back into the œsophagus. Peculiar, gurgling sounds frequently accompany these processes. As the sac enlarges, neighboring organs and structures undergo serious compression, which may occasion palpitation, difficult respiration, and symptoms of asphyxia. Regurgitation of decomposed and offensive food follows several hours after its deglutition. Sometimes so large a quantity of nourishment is thus intercepted that the patient is in danger of starvation. The introduction of a sound is sometimes followed by its entrance and arrest within the pouch. In certain cases another sound may be at the same time carried onward through the œsophagus into the stomach.

The treatment of œsophageal sacculation does not differ essentially from that which is required in dilatation or constriction of the œsophagus.

2. *Diverticula* may be formed in connection with the œsophagus by the establishment of adhesions between its external surface and neighboring bronchial or tracheal lymph glands which have undergone peri-adenitic inflammation (traction-diverticula). Subsequent contraction of the inflamed tissues causes traction upon the adherent wall, and thus a diverticulum may be formed. Similar adhesions and subsequent contraction in connection with any other adjacent tissue produce the same result. The pouch which is thus formed rarely exceeds half an inch in depth; consequently, it seldom produces any notable symptoms, and the principal danger which accompanies its existence lies in the tendency to perforation of the œsophageal wall through the diverticulum. In this way a communication may be established between the œsophagus and any of the neighboring cavities.

Catarrhal Inflammation of the Œsophagus—Œsophagitis Catarrhalis.

Etiology. Catarrhal inflammation may invade the œsophagus as a consequence either of mechanical injuries, or by reason of the passage of liquids that are too hot or too cold, or which possess a corrosive character. Chronic inflammation of the pharynx or of the stomach, and inflammation in other neighboring structures, may be propagated by continuity to the œsophagus. It not unfrequently accompanies acute

ive diseases; and it may be observed as a consequence of circulatory uction in the course of chronic diseases of the organs of circulation espiration.

ATHOLOGICAL ANATOMY. Catarrhal inflammation of the œsophagus exist as an acute or as a chronic disease. It may be either diffuse rcumscribed. *Acute catarrh* is indicated by softening and exfolia- of the epithelium, often accompanied by swelling and inflammation he mucous follicles. The mucous surface is, at first, dry, but after- l it is covered with a muco-purulent discharge. In severe cases it become actually eroded or ulcerated. Suppuration and gangrene rare events.

n *chronic catarrhal inflammation* of the œsophagus the mucous mbrane appears thickened and of a dark-red color. It is frequently rated, and the secretions are tenacious and muco-purulent. Papil- growths and polypi sometimes result from the chronic inflammatory cess.

YMPTOMS AND DIAGNOSIS. There is usually complaint of an ill- ned sensation of pressure, or of actual burning and smarting, along course of the œsophagus, which is referred sometimes to the neck, o the space between the shoulder-blades, or beneath the sternum, or he epigastrium. Deglutition is usually painful, and the various ements of the neck and body often excite a sensation of distress. glutition may be not only painful, but may become the occasion of ex spasms in the œsophagus or in the respiratory muscles, producing ensation of suffocation which, occasionally, results in convulsions. netimes the alimentary mass is regurgitated, and presents a slimy ering that is tinged with blood and mixed with pus. The introduc- n of a sound is usually followed by similar consequences.

In certain cases, as after swallowing acid or caustic liquids, the entire thelial layer of the mucous membrane may become detached, and be charged in the form of a continuous tube. In such cases the sub- cous tissues are usually involved, and severe constriction may follow process of cicatrization.

TREATMENT. Pain must be relieved by the use of morphine and pine, hypodermically. Ice may be given in small pieces, as desired. e food should consist of iced milk; if necessary, nutritious injections y be administered. Chronic catarrh of the œsophagus may be locally ated by the use of a probang covered with an astringent salve. . Acid. tannic. 1.0: vaselin. 10.0. ℞. Argent. nitrat. 1.0: vaselin. .0.)

Phlegmonous Inflammation of the Œsophagus—Œsophagitis Phlegmonosa.

This very rare disease is characterized by suppuration in the sub- cous connective tissue of the œsophagus, a process which may result the formation of a circumscribed abscess. During the development he disease the lumen of the œsophagus may be somewhat constricted. pture of the abscess may be followed by regurgitation of pus, or by passage downward into the stomach. Cicatrization may follow, or cavity of the abscess may become lined with epithelium, remaining

in the form of a pouch within the œsophageal wall. The disease may occur in connection with various infective diseases or suppurative processes in the neighboring structures. The symptoms are quite obscure, and the treatment must be conducted in accordance with general principles. In fact, it usually is merged in the treatment of the general condition of the patient.

Hemorrhage from the Œsophagus may occur as a consequence of injuries or wounds which communicate with large bloodvessels. It can occur as a consequence of ulcerative processes, or from varicose veins, such as may exist in connection with cirrhosis of the liver, by reason of which the return of blood through the inferior œsophageal veins, which anastomose with the coronary vessels of the stomach, is retarded.

Softening of the Œsophagus, chiefly implicating the inferior portion of the canal, has been observed. It is generally associated with similar conditions in the stomach. It can hardly be recognized with any degree of probability during life.

Spontaneous Rupture of the Œsophagus is a very rare event. Scarcely twenty cases are recorded. It usually occurs in men of intemperate habits and advanced life. The event is sudden, and is attended with severe pain between the shoulders. Symptoms of collapse and subcutaneous emphysema are speedily developed, and death follows in the course of a few hours.

Paralysis of the Œsophagus occurs usually as a consequence of diseases of the brain and cervical portion of the spinal cord. It has been observed as a consequence of compression of both pneumogastric nerves. Diphtheria, syphilis, blood-poisoning, and alcoholism have been known to cause the disorder. Occasionally it happens as a transient event in hysteria. The treatment must be regulated by consideration of the causes of the disease. Electricity is useful, except in cases which are dependent upon deep-seated and incurable degenerations of the nervous centres.

Spasm of the Œsophagus is a neurosis that may occur in connection with hysteria and other functional nervous derangements. It forms a distressing symptom in cases of tetanus and hydrophobia. In many instances it occurs as a transient phenomenon excited by reflex processes dependent upon disorders of the stomach, sexual apparatus, or other irritable portions of the body. Certain poisons, like belladonna and stramonium, and the toxæmia which characterizes the arthritic constitution, may produce the spasm. It is not uncommonly developed as an incident in the course of œsophageal examination with the sound. In excitable persons it often occurs in variable degree during the act of swallowing food or drink. It ordinarily subsides in the course of a few minutes, unless occasioned by poisoning or by dangerous diseases. If pain be unusually severe, it may necessitate the administration of narcotics. The galvanic current, in association with tonic and eliminative treatment, is useful in many cases.

CHAPTER V.

DISEASES OF THE STOMACH.

Gastric Hemorrhage—Hæmorrhagia Ventriculi.

ETIOLOGY. *Gastric hemorrhage* may occur as a consequence of ulds or injuries of the internal surface of the organ. Caustic ons, corrosive alkalies, and concentrated acids frequently occasion ncidence. It frequently occurs in connection with ulcerative pro- es that are dependent upon *round ulcer* of the stomach, *cancer*, or re *gastritis*.

Vascular disorders, and diseases involving the *gastric bloodvessels* occasion hemorrhage. Thus it may follow any condition of the by which is produced an obstruction in the course of the portal ulation.

Hysteria and injuries of the central nervous system are sometimes owed by gastric hemorrhage as a result of vasomotor disturbances.

Many of the *infective diseases* are accompanied by gastric hemor- ge. It is not uncommon in severe forms of malarial infection.

Hemorrhagic diseases, such as scurvy, purpura, and hæmophilia may occasion hemorrhage into the cavity of the stomach. Diseases of *liver* and *kidneys* are often attended by changes in the walls of the odvessels which favor the occurrence of hemorrhage. It may also ur by *substitution* in place of habitual discharges of blood, such as y be witnessed in suppression of menstruation, or upon the drying of bleeding piles. *Perforation* of the *walls* of the *stomach* by ghboring abscesses or aneurism is generally attended by more or hemorrhage.

Gastric hemorrhage occurs more frequently among women than ng men, in consequence of their greater proclivity to ulcers of the nach. It is most common between the age of puberty and the turn ife.

PATHOLOGICAL ANATOMY. After death from gastric hemorrhage the nach is sometimes found distended with clotted blood. If the amount hemorrhage has been moderate, small clots only, or liquids which mble coffee-grounds or chocolate, occupy the cavity. The mucous nbrane appears pale, and sometimes the ruptured vessels can be dis- ered; but frequently no definite source for the discharge of blood be detected (capillary hemorrhage). Blood is frequently found in intestines, and, if vomiting has preceded death, it is sometimes seen he air-passages also.

SYMPTOMS. Slight hemorrhage may occur without exciting any cial symptoms, but any considerable amount of blood will be either ited or voided by stool. The feces are black, sometimes very hard, emi-solid and exceedingly offensive. Vomiting brings to light dark

clotted blood, or, if the hemorrhage be excessive in amount, fresh arterial blood may appear. The contents of the stomach are highly acid, and are mixed with the remains of food and the débris of ulceration or malignant disease, if such processes have invaded the gastric walls. The patient complains of warmth and distention in the stomach. Sometimes the gush of blood can actually be felt. This is soon followed by nausea, vomiting, and in severe cases by the symptoms of collapse. If the larynx and trachea become obstructed by the entrance of blood-clots during the act of vomiting, asphyxia will follow. In certain instances, however, fatal hemorrhage may exist without either vomiting or the passage of blood from the bowels.

After severe gastric hemorrhage the patient remains pallid and debilitated for a considerable period of time. Relapses may occur. An œdematous condition of the face and extremities is not uncommon. The symptoms of anæmia are manifested in the condition of the circulation, by which cardiac and venous murmurs are developed. The blood exhibits a deficiency of red corpuscles, and sometimes there is an excessive production of white blood-corpuscles. The breath becomes offensive, and indigestion forms a prominent symptom. Evidences of general failure of nutrition exist, sometimes characterized by exfoliation of the epidermis, falling of the hair, or albuminuria. Occasionally, amaurosis occurs within a few days after gastric hemorrhage; its cause is unknown.

Diagnosis. Gastric hemorrhage may be suspected in cases of death rapidly following sudden collapse, preceded by symptoms of gastric disease, even though no considerable escape of blood has been observed. The occurrence of bloody stools is by itself no indication of gastric hemorrhage, since it may result from intestinal diseases. Blackened feces must not be accepted as evidence of hemorrhage unless the presence of iron, or bismuth, or other substances by which the feces may be darkened, can be excluded. Vomiting of blood cannot be received as evidence of gastric hemorrhage unless it be possible to exclude pulmonary hæmoptysis and hemorrhages from the mouth, nose, or other cavities whence blood may have found its way downward into the stomach.

The possibility of deception in cases of malingering or hysteria must not be forgotten. Certain articles of food or drink may sometimes produce a discoloration of vomited matter which closely resembles the appearances that are presented by more or less altered blood. Newborn children sometimes fill their mouths and discolor the contents of their stomachs with blood that has been sucked from the breast of the mother.

Prognosis. The prognosis is usually favorable so far as immediate consequences are concerned, but relapses and remote consequences are dependent upon the underlying causes of hemorrhage. Sudden death occurs only when a large vessel or aneurism is ruptured.

Treatment. The indications for treatment are threefold: to prevent hemorrhage, if it be threatened; to arrest actual hemorrhage; and to obviate its evil consequences.

The first indication requires attention to those diseases by which gastric hemorrhage may be produced.

The occurrence of actual hemorrhage demands perfect repose of nd and body on the part of the patient. Small pieces of ice may be allowed; an ice-bag should be laid over the pit of the stomach, and teen minims of ergotine may be injected hypodermically into the bcutaneous tissue of the epigastrium. Syncope may be relieved by pressing the head of the patient and by the use of stimulants, *e. g.*, cohol, ammonia, ether, and camphor (three grains dissolved in half a rachm of almond oil, hypodermically). After the cessation of vomit-g a lead and opium pill may be given every three or four hours, or n drops of aromatic sulphuric acid, in half a glass of water, may be iven at similar intervals. Alum whey is also an excellent styptic, and ay be given in doses of a wineglassful every fifteen or twenty minutes. apillary hemorrhage is sometimes benefited by the administration of il of turpentine in five-drop doses, to be repeated every hour. Hemor-hage that is dependent upon malarial infection requires large doses of uinine.

Desperate cases may be treated by transfusion of blood. After the pparent cessation of hemorrhage, if the bowels seem to be distended nd uneasy, they should be evacuated by the administration of a pow-der containing five grains each of calomel, jalap, and the bicarbonate of sodium.

The diet must consist at first of iced milk. The return to ordinary food must be considerably delayed and gradually effected. Subsequent anæmia and debility will be the occasion for great caution in the admin-istration of food and drugs, since iron cannot be employed if acute gastric inflammation exist.

Acute Gastric Catarrh—Gastritis Catarrhalis Acuta.

Etiology. *Acute catarrhal inflammation* of the *stomach* is gener-ally caused by errors of diet. *Food* which is either too hot or too cold, or excessive in quantity, or of a coarse and irritating character, is liable to excite gastric inflammation. In like manner, *spices*, *acids*, strong *liquors*, unwholesome *wine* or *beer*, and *impure water* may excite inflammation. *Unusual articles of food*, green fruit, seeds, stones, decomposing cheese and other substances which are undergoing fer-mentation or putrefaction, may also excite the disease. In this way tainted fish, mussels, oysters, ice-cream, milk, canned or compressed meats, sausages, old cheese, etc., may excite violent gastritis by the *ptomaïnes* that have been formed in their substance through bacterial ction. *Wounds* and *injuries* involving the stomach, and neighboring *nflammations*, are frequent causes of gastritis. It is frequently ob-erved in *cachectic* and *chlorotic patients*, and among the victims of *out* and *uræmia*. Diseases of the *thoracic organs* and of the *liver* hich hinder the circulation of blood, and states of *nervous excitement* hich disturb the processes of secretion and nutrition, are all liable to followed by catarrhal inflammation of the stomach.

Acute gastritis sometimes follows excessive exposure to *cold;* and it an almost universal complication of *infective diseases*, and of disor-rs of the *naso-pharyngeal* and *oral cavities*. Diseases of the *respir-*

atory organs which are accompanied by infective discharges frequently originate the disease if the sputa are swallowed.

PATHOLOGICAL ANATOMY. Catarrhal inflammation of the stomach principally affects the pyloric extremity of the organ. The mucous membrane is swelled, softened, reddened, and covered with tenacious mucus that is somewhat turbid, or even streaked with blood. The capillary bloodvessels are dilated, and submucous extravasations are frequently visible.

SYMPTOMS AND DIAGNOSIS. *Acute gastric catarrh* causes loss of appetite, thirst, nausea, and frequently vomiting. At first the contents of the stomach are discharged, usually in an undigested condition and very acid in consequence of the presence of lactic and butyric acids. Free hydrochloric acid is absent. If the stomach has been thus evacuated, persistent *vomiting* brings up a tenacious viscid mucus that is sometimes streaked with blood. After a time this assumes a yellowish or green color in consequence of the regurgitation of bile into the stomach. Sometimes there is a noisy hiccough and eructation of gases or acrid liquids which sometimes exhale an acid or sulphurous odor. A sensation of distention and of tenderness on pressure is often referred to the epigastrium. Deglutition of food under such circumstances is frequently followed by pain that is referred to the interscapular region, or is felt in the epigastrium. The *tongue* is very much coated, the breath is offensive, and a herpetic eruption sometimes appears upon the lips; the *bowels* are generally constipated, unless they also participate in the inflammatory excitement. The *urine* is diminished and concentrated.

The *nervous system* exhibits evidences of considerable disturbance. Headache, throbbing in the temples, depression of spirits, inability to concentrate the attention, and indisposition to mental exertion are commonly observed. Sometimes vertigo occurs.

Fever is usually quite moderate, except in the cases of children, who frequently exhibit the phenomena of high fever, sometimes complicated with convulsions. Severe febrile symptoms suggest the possibility of typhoid fever, but the sudden rise of temperature and the early termination of febrile symptoms are characteristic of catarrhal fever rather than of typhoid.

PROGNOSIS. The duration of acute gastric catarrh seldom exceeds a week, or two weeks at the longest. Relapses are not uncommon, and they predispose the patient to chronic catarrhal inflammation; otherwise, the prognosis is favorable.

TREATMENT. If the stomach be overloaded, it should be evacuated by means of a hypodermic injection of apomorphine, or by the administration of an emetic (pulv. ipecac., zinc. sulph., āā ℈j. Acidity and gaseous distention of the stomach may be relieved by alkaline drinks (a teaspoonful of bicarbonate of sodium in a glass of water). This should be followed by a powder containing five grains each of calomel and jalap; or by a teaspoonful of calcined magnesia stirred into a glass of water; or by two or three teaspoonfuls of compound licorice powder in water. A large, warm flaxseed-meal poultice should cover the entire surface of the abdomen. Pain may be relieved by the

nic use of morphine and atropine. The diet should consist of d lime-water, and should be very gradually restored to its quantity and quality. During convalescence dilute hydro- acid may be given in ten-drop doses, in a cup of tepid water, after each meal.

ronic Gastric Catarrh—Gastritis Catarrhalis Chronica.

LOGY. *Chronic gastric catarrh* is usually developed as a con- e of previous acute inflammation. It is exceedingly common drunkards. It is frequently observed among people who eat and at irregular times, without proper selection of their diet. and imperfectly masticated articles of food act as exciting f the affection. It is also observed in connection with ulcer- d cancerous diseases of the stomach; or as a consequence of in other organs by which the circulation of blood is retarded. ften witnessed among the victims of cachexia, anæmia, and diseases. The male sex affords the largest number of patients.

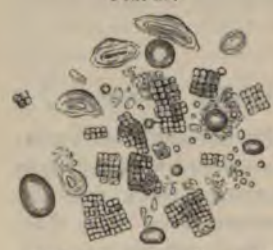
OLOGICAL ANATOMY. The pyloric portion of the stomach is rite seat of chronic catarrhal inflammation. The mucous mem- of a dark-red or gray color, the bloodvessels are distended, and ial extravasations and erosions are visible. The connective ontains red blood-corpuscles and blood pigment. There is con- e swelling of the mucous membrane; its surface is covered with s mucous, which may be tinged with blood and may contain pus les. The gastric glands are compressed, and their cellular e exhibits evidence of degeneration and atrophy. The inter- ar spaces are infiltrated with round cells. Mucous secretion is ly increased. The connective tissue is increased so that the wall appears considerably firmer and thicker than in health, and tic glands are correspondingly atrophied. The submucous and scular layers of the gastric wall participate in the inflammatory , and the external serous investment may also be thickened and d.

ld cases of long standing the mucous surface of the stomach uneven and warty, somewhat like a wound that is covered with nt granulations. This is caused by excessive proliferation in the ous tissue. The gastric wall is thus thickened and transformed irm and resisting mass which sometimes, on incision, creaks like that is cut with a dull knife.

PTOMS. The symptoms of chronic catarrhal gastritis differ from those of the acute form by their lesser degree of severity. is loss of appetite, a sensation of tenderness and distention in ion of the stomach; sometimes there are paroxysms of excessive and a longing for spices and pickles; thirst is usually increased. ion of gaseous and acrid liquids is a very common and disa- e symptom. Vomiting does not occur as frequently as in acute , though drunkards frequently retch and eructate considerable ies of mucus and saliva on arising in the morning. The gastric s not unfrequently contain bile and specimens of the yeast

fungus or sarcina. The tongue may be either completely clean and healthy, or it may be covered with a thick brown coat. In cases accompanied by anæmia and debility the tongue is pale, broad, and indented at the edges. The breath is generally quite offensive. The salivary secretion is increased; the stomach frequently appears considerably distended, and is tender on pressure immediately below the ensiform cartilage. The urine is generally diminished, and frequently exhibits a sediment containing urates, oxalates, or phosphates. The bowels are usually constipated, unless intestinal catarrh be associated with the gastric disorder. Vertigo is frequently experienced, especially on arising in the morning. Palpitation of the heart and other cardiac neuroses sometimes occur. The patient complains of great depression and gloom, which may increase to the proportions of actual melancholia. Agoraphobia and allied mental disturbances are sometimes experienced. In chronic cases the general health suffers, and a certain degree of emaciation may be observed. Eczema, urticaria, and hemorrhagic symptoms sometimes exist.

FIG. 89.



Sarcinæ ventriculi, with starch granules and oil globules, from vomited matters. (OTTO FUNKE.)

The duration of the disease is exceedingly chronic. Improvement or apparent recovery is liable to be followed by relapses, and the disease frequently continues until the end of life. Complete atrophy of the gastric glands produces progressive exhaustion, and death follows with the symptoms of progressive pernicious anæmia. In other cases dilatation of the stomach or malignant disease may result from chronic catarrhal inflammation.

DIAGNOSIS. In order to investigate accurately the condition and functional capacity of the stomach, it becomes necessary to withdraw a portion of its contents, and to subject them to chemical analysis. In this way the presence or absence of free hydrochloric acid and of pepsin and other ferments may be ascertained. In order to procure a specimen of the gastric contents, the patient should be instructed to take a meal consisting of a cup of tea, without sugar, and a biscuit. At the expiration of an hour the stomach may be evacuated by the aid of a gastric syphon-catheter, or an ordinary flexible rubber tube, which is introduced through the œsophagus into the stomach and connected with an aspirator. In this way two or three ounces of fluid may be withdrawn and, after filtration, subjected to analysis. If a more extended investigation be desired, the patient should be instructed to take a bowl of soup and a tender beefsteak, with an egg and a piece of bread. After the expiration of four hours the contents of the stomach may be withdrawn. If at the expiration of six hours the stomach contains a considerable quantity of liquid, its muscular power is evidently diminished, for after that length of time the healthy stomach should have been completely emptied by the propulsion of its contents into the duodenum.

Having withdrawn and filtered the contents, it becomes necessary to

termine the presence or absence of free hydrochloric acid. For this rpose a few drops of the filtered liquid may be added to a solution of ɔpæoline (0.05 : 200). If a *free acid* is present, the point of contact tween the two liquids is indicated by a violet-red color. Its presence also indicated by the appearance of a blue spot when congo paper is oistened with a drop of the gastric juice.

Having now determined the presence of a free acid, the liquid must e tested with phloroglucine-vanilline (phloroglucine, 2.0; vanilline, .0; alcohol, 30). This reagent must be kept in a colored vial, because t is readily decomposed in daylight. A few drops of the reagent must ɔe evaporated in a porcelain capsule with an equal quantity of gastric juice. The presence of *free hydrochloric acid* is indicated by a carmine-red residuum.

In order to ascertain the presence of *lactic acid*, it is necessary to employ a reagent composed of one drop of the chloride of iron and 10 c.cm. of a four per cent. solution of carbolic acid, diluted with 20 c.cm. of water. The addition of this reagent to a fluid containing lactic acid changes its blue color to a canary-yellow tint.

In order to ascertain the presence of *acetic acid*, the gastric juice should be agitated with ether, which should be then removed by evaporation; a portion of the remaining liquid must be mixed with water, carefully filtered, and treated with a drop of chloride of iron, when a blood-red color will be developed if acetic acid is present. Complete evaporation causes a reddish-brown deposit of basic acetate of iron. The remaining portion of the ethereal residue may be tested for the presence of *butyric acid* by the addition of a few drops of water and a minute fragment of chloride of calcium. If butyric acid is present, it will appear upon the surface of the liquid in the form of minute oil globules.

Having determined the presence of free hydrochloric acid, its proportionate amount must be ascertained by quantitative analysis. For this purpose it may be titrated with a standard decinormal solution of caustic soda, and the acid contents may be estimated by the equation 1 c.cm. of the standard solution = 0.003646 grm. of hydrochloric acid. Since it is known that normal gastric juice contains 0.15–0.25 of that acid, hypacidity of the gastric fluid will be indicated whenever it contains less than 0.15 per cent. of hydrochloric acid; while, on the ɔntrary, hyperacidity is indicated by the presence of anything more ian 0.3 per cent. of acid.

In order to test the presence of *pepsin*, equal-sized fragments of agulated egg albumen may be placed in four test-tubes, marked 1, 2, and 4. In the first may be placed a specimen of the plain gastric ce; in the second the same quantity should be mixed with five or six ains of pepsin; in the third it should be reinforced with one or two ɔps of hydrochloric acid; and in the fourth with both pepsin and drochloric acid. The four tubes should then be placed in a warm amber, at the temperature of the body. If the albumin in No. 2 is ry slightly, or not at all dissolved, there is lack of hydrochloric acid. the process of solution is very gradual in No. 3, a lack of pepsin is dicated; while in No. 4 normal solution should take place, since pepsin

and hydrochloric acid are here artificially combined. If similar solution takes place in No. 1, pepsin and hydrochloric acid are naturally present in normal quantity.

The presence of *milk ferment* in the gastric juice may be ascertained by the addition of an equal quantity of neutral milk to properly neutralized gastric juice, when the presence of ferment will be indicated, in the course of a few minutes, by the coagulation of casein.

In order to ascertain the *rate of absorption from the stomach*, the patient may be made to swallow a few grains of iodide of potassium in a gelatin capsule. The saliva should then be tested every five minutes for the presence of iodine. This may be rapidly accomplished by the aid of starch-paper and nitric acid. The presence of iodide of potassium will be indicated by a red or blue color when the paper is moistened with saliva and a drop of fuming nitric acid. In healthy persons the reaction should be apparent in the course of fifteen minutes, if the stomach be empty. Severe gastric disease occasions great delay in the reaction.

Having ascertained the condition of the gastric juice, it becomes necessary to ascertain whether other diseases of the stomach, especially *cancer* or *ulcer*, are present. The existence of a tumor in the epigastric region may be the consequence of other diseases by which the gastric wall has been thickened. The development of cachexia and advanced age favor the probability of cancer. The absence of hæmatemesis argues in favor of simple inflammation. Absence of free hydrochloric acid from the gastric juice, and the presence of enlarged lymph glands in the left inguinal region, or above the left clavicle, generally indicate cancer.

Hydrochloric acid may be absent in cases of chronic atrophy of the gastric glands; but blood, which is usually present in cancer, will then also be absent from the mucus that is vomited.

Ulceration of the *stomach* generally occurs in young, anæmic, or chlorotic females. The pain is more severe and circumscribed than in general catarrhal inflammation, and it is usually increased by taking food. Copious hæmatemesis also indicates gastric ulcer.

Prognosis. The prognosis in chronic gastric catarrh depends upon the cause, and upon the possibility of its removal.

Treatment. The diet must be strictly regulated, and the patient must be instructed that food shall be taken leisurely, in moderate quantities, and thoroughly masticated. The clothing must, also, be sufficiently warm to prevent the possibility of chill.

In all cases the greatest reliance must be placed upon the quality of the food. Soup, beef-tea, peptonoids, milk, and soft eggs are the articles most easily digested. Calves' brains, sweetbreads, pig's feet, and poultry stand next in order; then follow tenderloin steaks, well pounded and broiled. Still more substantial, but less easily digested, are roasted poultry and game, rare roast beef, veal, fish, macaroni, and soup. New bread, fats, starches, and vegetables must be forbidden; stale bread toasted may be allowed. It will be necessary to prescribe the amount of food, and the exact time for each meal; the *menu* should be frequently varied in order to prevent loss of appetite.

It occasionally happens that patients revolt against such regulation of their diet, and claim to feel better when they are allowed the use of mustard and spices, with dried and smoked meats.

Chlorotic and anæmic patients are frequently benefited by the administration of dilute hydrochloric acid in ten-drop doses in a wineglass of warm water about an hour after eating. If pepsin be deficient in the gastric juice, ten grains of the powder may be taken at the same time.

Fermentation in the stomach must be arrested by the use of salicylic acid (10 grains half an hour before each meal), or creasote (1 or 2 drops in pill form before each meal). When food stagnates for a long time in the stomach, and when there is excessive fermentation, it is well to empty the stomach every morning with a syphon, by the aid of which the stomach should be thoroughly washed with tepid water, and irrigated with a solution of salicylate of sodium, or of resorcin, or with a two per cent. solution of bicarbonate of sodium if there be great acidity.

When the peristaltic vigor of the stomach is reduced, bitters should be prescribed, *e. g.*, tincture of nux vomica (10 drops three times a day), elixir of calisaya bark (a tablespoonful three times a day), and infusion of condurango (a tablespoonful three times a day).

Severe gastric pain must be relieved by the administration of morphine (morph. sulph. ½ gr., acid. hydrocyanic. dilut. 3 gtt.). Extract of belladonna and hydrate of chloral are sometimes beneficial. Bismuth, nitrate of silver, and opium should be avoided if possible. Pyrosis and heartburn may be relieved by the use of calcined magnesia. Constipation requires the use of compound licorice powder (one or two teaspoonfuls in water at bedtime) or compound rhubarb pills.

The general health of the patient must be improved by change of air and occupation, cold bathing, massage, and exercise in the open air. Faradic electricity is very beneficial, when employed by the application of one pole upon the back of the neck, while the other is moved from place to place over the region of the stomach. The waters of various mineral springs have a well-deserved reputation in the treatment of chronic catarrhal gastritis. The alkaline springs should be advised in cases which are attended with excess of acid in the stomach. The alkaline chloride waters are more useful in cases that are accompanied by nausea and excessive secretion of mucus; and strong saline waters are indicated when constipation and hepatic obstruction exist. Anæmic patients are benefited by waters that contain iron.

Purulent Gastritis—Gastritis Phlegmonosa.

Purulent gastritis occurs during middle age more frequently among men than among women, and is usually excited by corrosive or caustic poisons, though it is sometimes developed in connection with infective diseases or as a consequence of injuries, errors of diet, and exposure to cold.

The inflammation may be either diffuse or circumscribed. It involves the submucous tissue, which becomes infiltrated with pus and the ordinary products of inflammation. This may involve the entire thickness of the gastric wall, and it may find its way into the cavity of

the stomach or of the peritoneum. The symptoms do not differ essentially from those which are presented by ordinary severe inflammation of the stomach. Only when pus appears in the vomit can the disease be certainly recognized. Sometimes a circumscribed abscess can be recognized as a distinct tumor beneath the abdominal wall. The course of the disease is usually brief. A fatal result is generally reached before the end of the second week. The treatment must necessarily be purely symptomatic.

Toxic Inflammation of the Stomach—Gastritis Toxica.

The term *toxic inflammation* is applied to all forms of gastritis that are produced by the ingestion of poisons. Of these the mineral acids, oxalic acid, caustic alkalies, arsenic, and corrosive sublimate are the most common. The mouth, fauces, œsophagus, and gastric mucous membrane are discolored and corroded in a manner that corresponds with the action of each article upon the external skin. Sulphuric acid blackens the membranes, nitric acid produces a yellow stain, and ammonia causes a gray or brown discoloration of the surface. In doubtful cases litmus-paper may be used to ascertain whether an acid or an alkali has been swallowed.

The amount of destruction which occurs in the tissues of the stomach is dependent upon the quantity of the poison that has reached its cavity. Death may result speedily from shock or from complete corrosion and perforation of the gastric wall; but recovery sometimes takes place, and is followed by cicatricial contractions that may lead to a fatal result at a later period. The inflammatory process is accompanied by severe burning pain that is referred to the epigastrium and along the spinal column. Hiccough and vomiting and unquenchable thirst torment the patient. Blood and débris exist in the matters that are vomited or are voided by stool. Peritonitis or perforation are indicated by the extension of pain, with increased prostration and other symptoms of peritonitis or collapse.

The indications for treatment are the neutralization of the poison with alkalies, if an acid have been swallowed; or with vinegar, if it were an alkali. The whites of eggs should be administered freely in cases of corrosive sublimate poisoning, and the stomach must be evacuated as speedily as possible. Subsequent gastritis should be treated on general principles, like any other form of acute inflammation of the stomach.

Gastric Ulcer—Ulcus Ventriculi Rotundum.

Pathological Anatomy. It is estimated that *gastric ulcer* exists in about five per cent. of the subjects which are examined after death. It occurs, in nearly half the cases, upon the posterior wall of the stomach; in about as large a proportion upon the lesser curvature and pyloric extremity of the organ. It it a rare event to find more than one ulcer. Its size may vary from half an inch to three or four inches in diameter. Its form is round or oval, with a sharply defined border

it had been punched out of the mucous membrane. Sometimes the ucous and muscular layers are also invaded, producing a funnel- d cavity with its point toward the peritoneal layer, which, at last, be itself penetrated. The consequences of such perforation are, ver, often averted by adhesive inflammation between the surround- eritoneal surface and adjacent structures. In this way, by adhe- with the neighboring peritoneal surface, a circumscribed abscess be formed which communicates with the cavity of the stomach. ther cases, when the gastric peritoneum effects an adhesion with a boring organ like the liver or the spleen, the substance of that forms the base of the ulcer, and may be invaded still further by inflammatory process. Large abscesses may be thus originated, may finally penetrate the diaphragm, opening a communication een the stomach and any one of the thoracic cavities or intra-tho- organs. The ulcerative process may involve the anterior wall of abdomen, thus originating a gastric fistula. The invasion of the oneal cavity results in peritonitis, which is usually fatal. In con- ion with these extensive processes arises great danger of arterial on and fatal hemorrhage.

ulceration does not result in perforation, recovery is not always id of evil consequences. Cicatricial contraction sometimes causes reduction in the dimensions of the stomach; the organ is some- constricted so as to resemble an hour-glass, or it may assume an ularly sacculated form, suggestive of the stomachs of a ruminating al.

TIOLOGY. The disease is most frequently observed among chlorotic g women during the first fifteen years of adult life. It sometimes rs in connection with *chronic infective diseases*, or as a consequence *rterio-sclerosis*, or of *pigmentary embolism* in the vessels of the ach.

temperate habits and *coarse vegetable food* favor the development e disease. It may also occur as a consequence of *inflammation* or *y* of the *stomach;* and it is not unfrequently observed after exten- *burns* or *scalds* involving the external surface of the body.

be circular form of a gastric ulcer seems to indicate its dependence local disease involving the bloodvessels and their branches. The ent occurrence of ulceration in syphilis, in consumption, and in rosis, which produce amyloid or fatty degeneration of the arterial , favors the opinion that ulceration is dependent upon *vascular se*. But it is probable that something more than vascular disease quisite to determine the occurrence of ulceration, otherwise that ess might be multiple, or nearly universal, instead of being restricted single point, as is usually the case. In like manner the depend- of the disease upon a *reduction* of the *alkalinity* of the *blood* is y probable, since a wider extension of ulcerative processes might be expected. It is probable that *local causes*, such as vascular ructions, injuries, and parasitic invasions, in concurrence with an ed condition of the blood, combine to favor the erosive action of gastric juice at the point of least resistance which has thus been ted.

SYMPTOMS. It is probable that small ulcers may exist without notable symptoms; at any rate, the occurrence of profuse *gastric hemorrhage* or *perforation* in a person who had previously enjoyed apparent health, can hardly be explained without the hypothesis of a preëxistent ulcer. Ordinarily, there is great complaint of *pain* in the region of the stomach, either immediately after eating, or one or two hours after the meal-time. Painful sensations are referred to the sub-sternal or ensiform region, or to the intra-scapular space. When ulceration affects the posterior wall of the stomach, pain is frequently increased by lying in the dorsal position. An increase of pain when other positions are assumed argues in favor of a corresponding location of the ulcer.

Vomiting is a very common symptom. It occurs especially in the morning, or when the stomach is empty. It sometimes follows the ingestion of particular kinds of food. Sometimes streaks of blood appear in the mucus that is evacuated. One of the most significant symptoms is the occurrence of *hæmatemesis;* it may be excited by unusual exertion, distention of the stomach, or as a consequence of menstrual suppression. The quantity of blood varies within very wide limits. It ordinarily appears in the form of dark clots which possess a very acid reaction. If very copious in amount, the blood may present an arterial character. It occasions vomiting, and, if hemorrhage be excessive, the symptoms of collapse are developed. The loss of a small quantity of blood does not produce such acute symptoms, but its presence is indicated by a coffee-ground sediment in the vomited matter. Sometimes the patient complains of a sensation of heat, or of trickling in the stomach, which is followed by vomiting. Occasionally, blood may find its way into the air-passages during the act of vomiting. The stomach is frequently distended and painful on pressure, especially if the seat of the ulcer be upon the anterior surface of the organ.

The gastric juice always contains an *excess* of *free hydrochloric acid*. The *bowels* are *constipated*, and altered blood is sometimes visible in the stools. The *urine* is scanty and diminished in quantity. The *appetite* and *thirst* often remain without notable change; and the general condition of the patient is often such as to excite surprise at the occurrence of gastric disease. As in other disorders of the digestive apparatus, there may be great depression of spirits, accompanied by sleeplessness.

Among the most formidable complications of gastric ulcer may be mentioned *peritonitis*, in consequence of perforation of the stomach. If the abdominal wall is penetrated by ulceration, subcutaneous *emphysema* has been observed. The various consequences of perforation and consequent communication with the thoracic cavities have already been mentioned. *Thrombosis of the portal vein* may arise as a complication.

As sequelæ of gastric ulcer are sometimes observed cicatrization and constriction of the pylorus, with subsequent *dilatation* of the *stomach*. Occasionally the pyloric orifice becomes incontinent by reason of ulceration and destruction of its muscular sphincter. One of the most formidable consequences of gastric ulcer consists in the development of *cancerous disease* at a later period of life.

DIAGNOSIS. The diagnosis of a gastric ulcer is usually easy when chlorotic young female exhibits hyperacidity of the gastric juice associated with pain, vomiting and hæmatemesis. But it is not always easy to differentiate the disease from other chronic gastric disorders, viz., chronic catarrhal inflammation, gastric neuralgia, cancer, and biliary colic, which are characterized as follows: 1. *Chronic gastritis* may be recognized by its dependence upon errors of diet; by the lesser degree and greater diffusion of pain; absence of hæmatemesis, and the comparatively speedy recovery. 2. *Gastric neuralgia* is not dependent upon taking food into the stomach, and is relieved by pressure upon the epigastrium. Hæmatemesis is absent, and there are usually other forms of associated neuralgia. 3. *Cancer of the stomach* occurs at an advanced period of life; is usually attended by cancerous cachexia; runs a rapid course, and occasions enlargement of the lymph glands above the left clavicle and in the groin. A tumor is sometimes present in the epigastrium, and free hydrochloric acid is absent from the gastric juice. 4. *Gall-stone colic* is accompanied by pain which is restricted to the region of the gall bladder. Vomiting and jaundice are commonly associated with the colic. Careful scrutiny of the stools may possibly result in the discovery of gall stones.

PROGNOSIS. The prognosis in gastric ulcer must be very guarded, since so many dangerous complications and sequelæ may attend its course.

TREATMENT. The patient should remain in bed, with a warm poultice over the stomach, and should be restricted to a milk diet. This may be given in the form of koumiss, or boiled in a thin porridge. It should be taken in small quantities and very frequently, so as to avoid distention of the stomach with curdled masses. Excessive acidity may be obviated by the use of lime-water or by the bicarbonate of sodium. If a milk diet cannot be tolerated, it may be mixed with an equal quantity of beef-tea, or, as substitutes, broths, skimmed free from grease, beef peptonoids, bouillon, and soft eggs may be given. Rectal feeding also becomes necessary.

Internal medication may be undertaken by the administration of subnitrate of bismuth, or the salicylate, in ten-grain doses three times a day. Nitrate of silver (one-sixth of a grain in pill form three times a day) and acetate of lead (in grain doses every two or three hours) are recommended. In cases associated with hepatic engorgement, Carlsbad waters, or the artificial Carlsbad salts, may be administered every morning, half an hour before breakfast. Severe pain must be relieved by hypodermic injection of morphine and atropine, or by the internal administration of morphine and hydrocyanic acid.

℞.—Morph. sulph. gr iv.
Acid. hydrocyanic. dilut. ♏ l.
Aquæ destill. ℥ ij.—M.

S.—One drachm three times a day.

Chloral hydrate, in ten-grain doses three times a day, is sometimes useful for the same purpose. Obstinate vomiting may be relieved by swallowing small pieces of ice, or by morphine in minute doses (one-

thirtieth of a grain every half-hour), or by the compound tinctu iodine (one drop in a wineglassful of water every two hours).

Perforation and peritonitis must be treated by warm pou externally, and large doses of opium (one grain every two h internally.

Cancer of the Stomach.

ETIOLOGY. *Cancer of the stomach* is a less frequent occur than gastric ulcer. It is observed in about two per cent. o patients who are examined after death. It is a disease of adv life, and is especially frequent among the poor whose diet is coars innutritious. Heredity is not without influence in its production males suffer somewhat more frequently than females. Certain cou and climates appear to be more than ordinarily favorable to the dence of the disease. Depressing influences of a psychical char intemperance in the use of strong alcoholic liquors, and chron eases of the stomach all operate to favor the development of canc

PATHOLOGICAL ANATOMY. Cancer of the stomach is, in the majority of cases, a primary disease. Its favorite seat is in the p region; after that, the cardia and lesser curvature of the orga most frequently invaded. Sometimes the disease appears as a ci scribed tumor; in other cases there is diffuse infiltration of the g wall. Cancerous tumors are irregular in form, and exhibit a ten to local degeneration and breaking down of substance. Infiltra attended with great thickening of the coats of the stomach, so t cavity is often considerably reduced in size. The mucous mem becomes ulcerated, but gangrenous processes are rarely observ reason of the antiseptic properties of the gastric juice. The unin portions of the mucous membrane are generally the seat of c catarrhal inflammation.

Cancer of the stomach most frequently exhibits the scirrhous va soft cancers of the medullary variety stand next in order; colloid cancer is very likely to involve the peritoneum.

Invasion of the pylorus frequently occasions obstruction and tion of the stomach. The weight of the tumor sometimes displac pyloric extremity, so that it may lie in the iliac or hypogastric re

Profuse hemorrhage may occur as a consequence of degenerat erosion of a large bloodvessel. In other cases the hemorrhage stricted to a capillary oozing from the affected surfaces. As a quence of the propagation of the disease along the lymph vessel veins, distant organs may become involved by the formation of se ary tumors. Circumscribed peritonitis may also occur. The glands within the abdominal and thoracic cavities generally sh the process of cancerous infiltration. Brown atrophy of the fatty or amyloid degeneration of the heart and kidneys, and evidences of chronic marasmus, are frequently observed.

SYMPTOMS. Cancer of the stomach not unfrequently develo sidiously, without local symptoms, the only evidence of its exi being furnished by indigestion and progressive cachexia. The ence of a *tumor* in the gastric region forms one of the most imp

local signs. Frequently the growth is concealed behind the stomach, in its posterior wall, so that it only becomes apparent after it has attained considerable magnitude. When it can be felt, it presents the form of a round, or oval, or somewhat irregular mass, which is not displaced by the movements of respiration unless adhesions have been contracted with the liver or with the diaphragm. The position of the body frequently influences the location of the tumor, so that it can sometimes be detected more easily when the patient lies upon one side or assumes the knee-elbow posture. Distention of the stomach with food or with gas sometimes aids in rendering the tumor more prominent. If it lies upon the abdominal aorta, pulsations may be perceptible, but they differ from the uniformly expansive pulsations of aneurism. Percussion over the tumor indicates tympanitic dulness. Auscultation gives no decisive indications.

In the absence of a tumor the *general symptoms* and the occurrence of *gastric hemorrhage* afford the most valuable indications of disease. Hemorrhage is usually very moderate and the vomited matters rarely contain clotted blood. On the contrary, the presence of blood is indicated by the characteristic coffee-ground sediment, which consists of broken-down blood corpuscles and dark-brown pigment. The stools should be carefully examined for indications of blood. Sometimes cancerous elements may be discovered by the aid of the microscope.

Mucus and bile are frequently vomited by cancerous patients, and when such an event frequently recurs in the case of an elderly person, and is associated with progressive emaciation, cachexia, and infiltration of the lymph glands in the neck and groin, the probability of gastric cancer reaches a very high degree.

The function of *digestion* is very seriously disordered in cancer of the stomach. Eructation of acid and, sometimes, offensive gases is a very common incident. Free hydrochloric acid and the gastric ferments are usually absent from the gastric juice. The *process of absorption* is greatly retarded, as may be shown by testing the saliva after the administration of iodide of potassium; and the peristaltic movements of the organ are also greatly impeded, so that food may remain for an unusual length of time in its cavity.

Pain, of a boring or burning quality, is often experienced, especially after taking food. Associated neuralgic pains, and paroxysms of asthma, or angina pectoris, sometimes occur. There is tenderness on pressure over the stomach. The *tongue* is frequently coated or excessively red and fissured, especially when acid vomiting often occurs. The *bowels* are almost always constipated, though, in the later stages of the disease, diarrhœa sometimes exists as a consequence of the extension of catarrhal inflammation to the intestinal surfaces. The *urine* is scanty, and sometimes contains large quantities of indican, which may be recognized by adding two or three drops of a concentrated solution of chloride of calcium to a test-tube containing equal parts of urine and pure hydrochloric acid. Loss of appetite, progressive emaciation, universal distress, insomnia, and general prostration gradually wear out the patient. Sometimes *fever* is developed as a

consequence of septic poisoning during the absorption of broken-
cancerous masses.

The duration of the disease is difficult to ascertain, in conseq
of the insidious character of its invasion. Death occurs, sometim
the course of a few weeks. Life has been prolonged in certain
for two or three years; generally the younger the patient the
rapid the course of the disease.

Among the *complications* of gastric cancer are *dilatation o*
stomach, by reason of pyloric constriction; *pyloric insufficiency*,
consequence of destruction of its sphincter muscle; *œsophageal*
striction, as a consequence of cancer involving the cardiac orifice
organ; sometimes *secondary invasion of the liver* or other organs
duces symptoms which quite overshadow the primary gastric di
In like manner, *copious hemorrhage*, or *peritonitis*, or the *invas*
the other digestive organs and cavities, may produce an overwhe
array of symptoms leading directly to death.

DIAGNOSIS. The recognition of cancer of the stomach is not a
easy during life. Not unfrequently old people gradually waste
and die without any objective symptoms which particularly attra
attention, but after death an unsuspected cancer may be found
stomach. All doubtful cases should be carefully examined with
ence to the condition of the gastric juice, though free hydrochlori
is frequently absent in conditions of amyloid degeneration of th
neys, liver, or spleen. Those diseases are so rare that cancer sho
suspected whenever hydrochloric acid cannot be detected in the
juice. The retardation of gastric absorption which is shown
iodide of potassium test, affords one of the best evidences of
cancer, though it does sometimes occur when chronic gastric cata
dilatation exist. It must not, however, be concluded from the pr
of free hydrochloric acid that a latent cancer of the stomach m
exist, for sometimes indigestion, cachexia, and enlargement
supra-clavicular glands form the only evidences of the disease. It
desirable to estimate the amount of hæmoglobin in the blood
gastric cancer is rarely present when the amount of hæmogl
greater than sixty per cent. of the normal quantity.

When an abdominal tumor can be recognized during life it m
differentiated from enlargement and neoplasms of the liver or spl
its lack of mobility during the movements of respiration. It must
carefully differentiated from fecal and intestinal tumors, from enlarg
of the lymph glands, from tumors involving the pancreas, the mese
the uterus, and the ovaries, and from aneurismal dilatation an
cumscribed peritoneal effusions. Great assistance can be obtain
filling the stomach with gas, either by inflating it with the aid
bulb of a spray apparatus, or by making the patient swallow a tea
ful of bicarbonate of sodium dissolved in a wineglass of water, fo
by a similar solution of a teaspoonful of tartaric acid. By the
ing liberation of gas the stomach will be inflated, and the tumor
correspondingly displaced.

Having demonstrated that the tumor is of gastric origin, it m
differentiated from cicatricial indurations produced by previous u

is, and from foreign bodies which have been intruded into the mach. The diagnosis of cancer will then be established by the con- rence of advanced age, retarded absorption, persistent absence of e hydrochloric acid, and progressive cachexia.

TREATMENT. There is no remedy yet discovered for the cure of ncer. Surgical operations afford temporary relief in a few cases, but e generally either immediately fatal or speedily followed by a relapse the disease and death. The principal recourse for the relief of the atient lies in the administration of narcotics for the relief of pain, rigation of the stomach if its cavity be dilated, restriction of the diet skimmed milk, soft eggs, beef-tea, and peptonoids. The infusion of ondurango, in tablespoonful doses two or three times a day, has been ecommended. Pepsin and hydrochloric acid rarely accomplish much enefit.

Polypous tumors sometimes occur in connection with chronic catarrhal gastritis, and may, by their size and number, occasionally obstruct the pyloric orifice of the stomach. Sarcoma, papilloma, myoma, adenoma, lipoma, lymphangioma, teleangiectasis, and cystic tumors have been described in connection with diseases of the stomach.

Dilatation of the Stomach—Gastrectasis.

ETIOLOGY. Any cause that interferes with the propulsion of the contents of the stomach will produce dilatation of the organ. This may be transitory, when it depends upon accidental and transient causes, like excess of eating, or it may be permanent when chronic dis- eases interfere with the expulsion of food through the pylorus. Hence, the most common cause of dilatation lies in *constriction* of the *pylorus* or of the *duodenum*. This condition is usually produced by cicatriza- tion of an ulcer that encroached upon the pyloric portion of the stomach. Cancerous disease of the pylorus, muscular hypertrophy dependent upon hronic gastritis, and polypous tumors which develop in the neighbor- ood of the pylorus are among the most common causes of stenosis. imilar incidents involving the upper portion of the duodenum may fect like results. Sometimes *tumors* which originate outside of the mach may compress the pyloric orifice of the duodenum, and thus oduce stenosis. *Wandering kidney*, when the right kidney is dis- ced, may produce a similar effect, though in what way it is accom- shed is not yet decided. *Congenital constrictions* of the pylorus y sometimes operate as a cause of dilatation.

Dilatation of the stomach is not unfrequently occasioned by *deficient* or in its *muscular layer*. This lack of tone may be dependent n chronic catarrhal inflammation, or it may exist as a consequence defective nutrition subsequent to wounds, injuries, or chronic diseases ich are attended with deficient absorption and assimilation.

Gastric dilatation is a not uncommon event among those who *eat* and *ink inordinately;* hence, it is more frequently observed among people o live upon a vegetable diet. It may be observed as a consequence the excessive consumption of liquids by diabetic patients, and in one

case, at least, it has been known to occur by reason of the intemperate use of milk by a patient who had learned to relieve gastralgia with a mouthful of milk whenever pain recurred. He consequently found it necessary to carry a bottle in his pocket, from which he took a draught every few minutes, gaining in the course of some months over eighty pounds in weight, and acquiring a stomach that would contain at least a water-pailful.

PATHOLOGICAL ANATOMY. The stomach becomes, in certain cases, immensely enlarged, and occasions a corresponding displacement of other organs. The diaphragm is crowded upward, and the heart is displaced to the left. The cardiac portion of the stomach exhibits the greatest evidence of dilatation, in which the œsophagus sometimes takes part when the pylorus or duodenum are constricted. The mucous membrane of the stomach is in a state of chronic catarrh. The muscular layer is greatly hypertrophied when nutrition is not reduced, but it is atrophied when exhausting diseases interfere with nutrition.

SYMPTOMS AND DIAGNOSIS. The symptoms of dilatation of the stomach depend upon the chemical changes which take place in the gastric juice, and upon the physical alterations which the organ itself has experienced. In the early stages of the disease the errors of digestion that it produces are similar to those which occur in connection with chronic gastric catarrh, but, as the disease advances, nutrition fails; emaciation, pallor, and debility make startling progress. The *appetite* sometimes fails, or is replaced by *excessive hunger*, especially when the contents of the stomach are voided by vomiting rather than by passage into the duodenum. *Hiccough* and *heartburn* are not uncommon. The gases which are eructated are generally odorless, though sometimes offensive, and occasionally they contain inflammable marsh gas, which may be actually ignited as it escapes from the mouth. *Vomiting* is one of the most common occurrences during the early stages of the disease; but, as the stomach enlarges, it occurs less frequently. The gastric contents are thrown up with very little apparent effort, and they exhibit a degree of acidity that is sometimes sufficient to corrode the teeth. Frequently the evacuated liquids ferment and froth like yeast after they have been vomited. They contain lactic, butyric, and acetic acids, together with undigested food. Microscopical examination frequently discovers yeast cells and sarcinæ ventriculi, together with numerous other parasitic organisms.

In severe cases of dilatation the gastric region is inordinately prominent, and extends below the navel. In emaciated patients the contour of the organ can frequently be discerned through the wall of the abdomen, and its peristaltic movements may be readily perceived. This movement is occasionally excessive, and productive of great uneasiness and distress in the abdominal region.

Palpation encounters a feeling of resistance, like that of a bladder filled with water, and in this way the dimensions of the organ can be quite accurately marked out. When gas and liquids occupy the stomach at the same time, a loud succussion sound can often be heard when the body is violently shaken. This symptom, however, must not be referred to dilatation of the stomach unless other evidences of that con-

n exist, for it frequently is present in healthy stomachs when water air jointly occupy its cavity. Sometimes a sense of fluctuation be distinguished on pressure over the stomach. Sometimes, when ng œsophageal sound has been introduced into the stomach, its it can be felt by pressure through the abdominal wall over the ater curvature of the organ.

Percussion occasions a deep, tympanitic, and frequently metallic note r the dilated stomach. Dulness may be recognized over those portions ch are occupied by liquid, and its location varies in accordance with position of the patient. In cases of obscurity the stomach may be ated by the aid of the bulb of a spray apparatus in connection with œsophageal catheter, or by the liberation of carbonic acid within gastric cavity (p. 342), and the outlines of the dilated organ can be n readily defined by percussion. If, under such circumstances, the mach does not become inflated, but the intestines receive the gas, it vidence of *pyloric incontinence*, a condition that is not inconsistent h gastric dilatation.

Auscultation of the stomach, while its cavity is occupied by freshly rated carbonic acid gas, renders audible the crepitant air-bubbles ich form and break upon the surface of the liquid. In this way the its of the organ may be defined by audible sounds.

Sometimes the diagnosis can be assisted by distending the colon with ter from a fountain-syringe. In this way the line of demarkation ween the stomach and the intestine may be more readily per- ved.

Gastric digestion is very greatly retarded in cases of dilatation of organ. The gastric syphon frequently brings to view fragments of l which were swallowed several days previously. The process of *orption* is also greatly impeded, so that the recognition of iodide of assium in the saliva may be delayed for one or two hours, instead of earing at the expiration of ten or fifteen minutes, as it should do in lth.

As a consequence of *fermentation* in the gastric contents, acetic acid, ic acid, butyric acid, carbonic acid, and free hydrogen are produced the progressive oxidation of the products which follow the action rganized ferments upon sugar. These acid bodies are present in t abundance, while free hydrochloric acid is absent when gastric tation is dependent upon cancerous disease.

The *bowels* are usually much constipated, and the *urine* exhibits alkaline reaction, with an abundance of triple phosphates in the ment.

Progressive *debility*, universal *discomfort*, *cardiac palpitation*, and fective *dyspnœa* are matters of common occurrence. Frequently cardiac apex is displaced into the fourth intercostal space by reason he upward pressure of the stomach. The duration of the disease is edingly variable, and may be very greatly protracted in cases that not dependent upon malignant disease.

TREATMENT. For the local relief of the stomach the organ should vacuated by the aid of a gastric syphon, which consists of a funnel rubber tube, connected by a glass tube with an ordinary soft gastric

catheter. Having introduced the catheter through the œsophagus into the stomach, tepid water may be poured through the funnel into the tube until it is filled; then, compressing the tube immediately under the funnel, and depressing its orifice below the level of the stomach, water and the liquid contents of the organ will escape when pressure is removed from the pipe. If the entrance of the catheter should become obstructed, it may be reopened by pressure over the abdominal wall, or by the aid of the abdominal muscles. If this expedient prove unsuccessful, it may be necessary to raise the funnel and again to pour a little water through the tube. In this way, with a little patience and perseverance, difficulties can be overcome which at first arise from the irritability of the fauces. The operation of syphoning the stomach is very easy, and many persons readily learn to perform it for themselves. The use of such an instrument is much easier and safer than an attempt to evacuate the stomach with an ordinary stomach-pump.

The evacuation of a dilated stomach by the above method produces great relief from the symptoms which depend upon distention of the organ. Sometimes the operation is attended by dizziness, singing in the ears, and muscular spasm, that has, occasionally, been followed by death; but similar consequences have been observed after simple vomiting, so that it is probable that such formidable symptoms result from the extension of a purely local irritation to central nervous organs which have been already dangerously intoxicated by the absorption of morbid products from a diseased stomach.

Having evacuated the stomach, it is desirable to invigorate the contractile power of its muscular layers; consequently, the patient should be placed in bed for a number of hours, with an ice-bag over the epigastrium. A hypodermic injection of ergotine, or of the nitrate of strychnine (one-fortieth of a grain) should be made into the anterior wall of the abdomen. The daily application of the faradic current should follow the operation, and may be continued from five to ten minutes, with one pole applied to the back of the neck, while the other is moved about over the anterior wall of the abdomen.

Five grains of resorcin, or ten grains of salicylic acid, should be taken an hour before the principal meal, in order to disinfect the gastric cavity. Food should be given, in small quantity, every two hours; and it must be chiefly of animal origin. Liquids, fats, and starches must be avoided as much as possible, in order to prevent fermentation and distention of the stomach. The general health should be cared for in accordance with general principles.

Softening of the Stomach—Gastromalacia. It sometimes happens that after death the stomach presents evidences of softening, which may also be attended by discoloration of the bloodvessels in those portions of the organ that contain liquid. In certain cases the gastric wall is found to be ruptured, and its contents have found their way into the peritoneal cavity. Much discussion has arisen regarding the nature of this process. By the majority of authors it is thought to be a post-mortem consequence of the action of gastric juice upon the mucous membrane and upon the blood that is contained in its vessels; but, by

me, the opinion is still held that it is actually an ante-mortem event. t any rate, its occurrence cannot be recognized during life, and it ssesses only an anatomical importance.

Rupture of the Stomach sometimes occurs as a consequence of actual olence. It may occur in connection with inflammatory processes in eighboring organs that encroach upon the gastric wall; and it has metimes happened after the introduction of foreign bodies into the vity of the organ. Its occurrence is indicated by sudden pain, col- pse, tympanites, and peritonitis.

Gastric Parasites. Besides the ordinary parasites which may exist the stomach, maggots and other larvæ have occasionally been found vomited matters, evidently derived from eggs that have been swallowed ith the food. Numerous vegetable parasites are sometimes found. esides yeast fungus, Oïdium albicans, Penicillium glaucum, Favus, arcina ventriculi, and many varieties of the schizomycetes have been iscovered in the gastric contents.

CHAPTER VI.

FUNCTIONAL DISEASES OF THE STOMACH.

Motor Neuroses.

Nervous Vomiting—Emesis Nervosa.

Etiology. Under the head of *nervous vomiting* must be included ll those cases of emesis that are not dependent upon local excitement n the stomach, or which are occasioned either by direct disturbance or disease of the vomiting-centre in the medulla oblongata, or as a conse- uence of its mediate irritation through impressions that are conveyed o it from distant organs of the body. The vast majority of cases, there- ore, are the result of reflex influences.

Direct disturbance by which vomiting is produced may be observed n cases of hemorrhage, softening of the brain, tumors, shock, and ounds that affect the medulla oblongata.

Psychical causes which operate through the brain may excite vomit- ng through their influence upon the medulla. It is also observed in he majority of *acute diseases* of the *brain*, and during the development f *cerebral tumors*. *Variations* in the *cerebral circulation*, and *unusual ovements*, such as swinging, seesawing, carriage riding, and sailing, requently excite vomiting.

Myelitis, multiple sclerosis of the brain and spinal cord, and other *pinal diseases*, are sometimes accompanied by vomiting; but it is most

frequently observed in *tabes dorsalis* under the form of gastric crises which sometimes occur with great regularity and frequency.

Irritation of the *peripheral nerves* in any part of the body is frequently followed by vomiting, in persons of a delicate and sensitive nervous organism. In this way, any excitement of the fauces, pharynx, nasal membranes, and auricular passages, may excite a paroxysm. In like manner, severe respiratory and cardiac diseases are not unfrequently associated with vomiting. Irritation of the pneumogastric nerve by tumors and enlarged glands in the neck may produce a similar result.

Any form of *abdominal excitement*, such as occurs at the onset of acute inflammation, embolic processes, calcular obstructions, hernia, intussusception, or other obstruction of the intestinal canal, is frequently attended by vomiting.

Diseases and excitement or injury of the *sexual organs*, both among males and females, are not uncommon causes of gastric disturbance and vomiting. The vomiting of pregnancy, and that which is occasionally observed at the time of menstruation, are familiar examples of this variety of nervous disturbance.

As a consequence of *impregnation* of the *blood with certain poisons of internal origin*, as may be observed in uræmia, in cholæmia, and in the course of many infective diseases, vomiting is produced by the direct action of contaminated blood upon the centres in the medulla oblongata. In a similar way may be explained the action of various *drugs* which excite vomiting when introduced hypodermically, or by inhalation, *e. g.*, apomorphine and ether.

Symptoms. Notwithstanding frequent recurrence of nervous vomiting, many patients experience no sensible diminution of health or of vigor; but sometimes, as may be observed in the vomiting of pregnancy, great emaciation and exhaustion are produced through the continuous evacuation of the stomach, and the impossibility of retaining nourishment. The tongue remains clean; appetite is often vigorous; pressure produces no evidence of tenderness over the stomach; the urine is generally diminished in quantity and rich in urates; sometimes it is suppressed in hysterical subjects, and the vomited matters may contain urinary constituents.

Diagnosis and Prognosis. A purely nervous cause should never be assumed for persistent vomiting, unless other diseases can be excluded. When the *tongue* remains clean, and there are no evidences of gastric disease or indigestion, a nervous origin is altogether probable. The *urine* should be frequently examined, in order to guard against the possibility of a latent nephritis. The *eye-grounds* must also be carefully investigated with the ophthalmoscope for evidences of cerebral tumor, and all the organs of the body, especially the *generative apparatus*, should be thoroughly and repeatedly scrutinized. The prognosis is usually favorable, unless incurable diseases of the nervous system exist.

Treatment. The treatment must be addressed to the central or peripheral causes, so far as they can be ascertained and subjected to remedial measures. Temporary relief can be procured by the use of

ıd narcotic remedies, especially morphine and atropine hypoderm-
, or hydrate of chloral in doses of a half-drachm when needed.
ine, bromide of potassium, subnitrate of bismuth, nitrate of silver,
he various ethereal preparations sometimes afford relief. If any
nce of fermentation appear in the gastric contents, creasote or
compound tincture of iodine may be administered with benefit.
nausea of pregnancy may sometimes be allayed by sipping very
water, a teaspoonful at a time, whenever the sensation recurs.

Eructation—Eructatio Nervosa.

ysterical and neurasthenic patients not unfrequently experience
xysms of *eructation*, during which immense quantities of air are
hed from the stomach, with more or less consequent relief. Some-
s the occurrence marks the termination of an hysterical paroxysm.

Rumination—Ruminatio.

)ccasionally the food is regurgitated into the mouth shortly after
ng, where it may be again subjected to mastication by the patient.
s event has been rarely observed and described. It occurs more
quently among males than among females, and is usually an event
childhood or early life. Heredity, imitation, congenital weakness
the cardiac sphincter, nervous debility, improper diet, gastro-intes-
al catarrh, and any depressing influence that operates upon a deli-
e nervous organism may serve to excite the disorder. It is usually
ercome by attention to the general health, proper regulation of the
t, and a serious effort on the part of the patient to resist regurgita-
n.

Sensory Neuroses of the Stomach.

Gastralgia.

Etiology. *Gastralgia* signifies pain located in the stomach, and
curring without any discoverable anatomical basis. It occurs most
equently among debilitated and chlorotic individuals. *Lead poison-
g, excessive mental excitement, anxiety, venereal* and *alcoholic dissi-
tion* are, not unfrequently, antecedents of the disorder. It is not
common as a consequence of the *arthritic diathesis*, and during the
urse of *malarial infection*, or as a consequence of other *infective
eases*. It is often observed in connection with *tabes dorsalis*
l other *diseases* of the *nervous system*. It may be excited in a
lex manner by disorders of the other *abdominal* or *pelvic organs;*
)ce its frequency in uterine and ovarian diseases. Sometimes it
urs in connection with *chronic diseases* of the *heart*.

Gastralgia is more common among women than among men, espe-
ly during the period between the age of puberty and the meno-
se.

Symptoms. *Gastralgia* sometimes occurs without warning, but fre-
ntly it is preceded by sensations of distention in the stomach, accom-

panied by eructation, nausea, vomiting, headache, and depression of the spirits. The pain is often excruciating, and is usually experienced in the epigastric region, whence it sometimes radiates between the shoulder-blades or over the anterior surface of the abdomen. It is aggravated by gentle pressure, but is relieved by firm compression of the abdominal wall. The course of the paroxysm is marked by all the evidences of intense suffering, and sometimes is associated with faintness and muscular spasms. The termination of the paroxysm is frequently marked by the occurrence of eructation or vomiting.

The *bowels* are usually constipated; the *urine* is often scanty, and throws down an abundant sediment of urates. In hysterical cases the conclusion of the attack is marked by a copious discharge of pale urine.

The *duration* of the paroxysm is exceedingly variable; it may recur only at long intervals or at stated periods; and it is sometimes repeated several times a day. It is not unfrequent in connection with the *catamenial discharge*, or as a consequence of *mental* or *physical excitement*. It is sometimes accompanied by paroxysms of intense hunger, or longing after extraordinary and indigestible articles of food and other strange perversions of appetite. Frequently it alternates with other forms of neuralgia or headache.

DIAGNOSIS. Gastralgia must be differentiated from the following diseases: 1. *Rheumatism of the abdominal muscles*, which is characterized by a greater continuity of pain that is increased by pressure, and is subject to frequent changes of place. Muscular movement also increases the pain, and it is diminished by relaxation of the abdominal walls. 2. *Intercostal neuralgia* is marked by the restriction of pain to particular intercostal spaces without gastric disturbances. The painful points of neuralgia are sometimes also present. 3. *Circumscribed peritonitis* may be recognized by the causes of the affection, by great tenderness on pressure over the abdomen, and by the absence of paroxysmal pain. 4. *Biliary colic* is indicated by restriction of the pain to the region of the gall-bladder, by the presence of icterus, and by the possible discovery of gall-stones in the stools. 5. *Irradiated neuralgia* sometimes accompanies urinary colic, pleurisy, or pericarditis.

PROGNOSIS. The prognosis is favorable, though relapses are not uncommon.

TREATMENT. The treatment must be addressed to the removal of the causes of the disorder, and to the relief of pain. For this purpose, it will be necessary to ascertain the condition of other organs besides the stomach, and to institute their appropriate treatment. Malarial neuralgia requires the administration of quinine and arsenic.

For the relief of a paroxysm of gastralgia a hypodermic injection of morphine and atropine must be given, and a large flaxseed-meal poultice, sprinkled with a drachm of chloroform, should be laid over the epigastrium. Chlorodyne and other narcotics are frequently useful. In obstinate cases relief is often procured by syphoning the stomach, and washing it out with tepid water. The daily use of electricity, with application of the anode to the epigastrium and of the cathode to the spine between the shoulders, affords excellent results.

peracidity or **hypacidity** of the gastric juice sometimes occurs
ıt the existence of organic diseases that can be recognized. They
ɔe relieved by attention to the general health, and by the internal
ıistration of alkalies or acids, in connection with bitters and
.

:cessive secretion of the *gastric juice* has been occasionally ob-
d; it is indicated by the eructation of an inordinate quantity of
l, attended by heartburn and thirst, without any indications of
ıic disease. Relief may be obtained by daily irrigation of the
ıch, and by the use of flesh diet.

Nervous Dyspepsia—Dyspepsia Nervosa.

TIOLOGY. *Nervous dyspepsia* occurs during middle life, more fre-
ıtly among men than among women. It is usually the consequence
:cessive cerebral excitement, overwork, dissipation, anæmia, chronic
nic diseases, prolonged lactation, sexual disorders, and a great
ety of nervous diseases. Alcohol, tobacco, malaria, uræmia, and
æmia are common causes.

YMPTOMS AND DIAGNOSIS. *Nervous dyspepsia* comprises all cases
ifficult digestion which cannot be referred to actual disease of the
ıach. It frequently is excited by reflex causes.

he disorder is attended by considerable *uneasiness*, that is most
ıon after the principal meal of the day, and is prolonged during
whole course of digestion. Sometimes there is a sensation of *dis-*
ion and *pressure* in the *epigastrium*, that is relieved by compression.
rtburn and *eructation* are common. *Thirst* is increased, and there
ısually a lack of *appetite;* sometimes there are perversions of
etite. The *tongue* is clean; the *bowels* are constipated, and *hyster-*
sensations are not uncommonly experienced in the throat, as if a
were moving up and down the œsophagus. There is complaint of
ess and *dizziness* in the *head*, with noises in the ears, flashes of
t before the eyes, and a dull headache. The *spirits* are greatly de-
sed, and *sleep* is disturbed at night, though frequently an inclina-
to sleep after meals is experienced. Sometimes *asthmatic sensa-*
and *attacks* of *palpitation* are experienced. The general health
nutrition suffer.

REATMENT. The diet must be judiciously regulated, and a change
ir and occupation should be secured, if possible. Sponge baths,
ions of the skin, massage, and the use of electricity are of great
e. Great benefit is often obtained in the treatment of neu-
ıenic and hysterical patients by the adoption of Weir Mitchell's
ıod, which consists in the removal of the patient from home, and
ınctory feeding at short intervals with milk, eggs, and broths, for
h more substantial food is gradually substituted. Daily massage
electricity are employed instead of active exercise during a period
x or eight weeks.

ck Headache—Gastroxynsis. Certain delicately organized indi-
ıls experience, at stated intervals, a paroxysm which may continue

from one to three days, and is characterized by excessive acidity of the stomach, nausea, sometimes vomiting, and severe headache. Relief speedily follows evacuation of the stomach by vomiting, or by irrigation with the gastric syphon. The treatment must be addressed to the general condition; and, during the course of the paroxysm, may be limited to the use of the syphon or the ingestion of a few cups of hot tea.

CHAPTER VII.

DISEASES OF THE INTESTINES.

Acute Catarrhal Inflammation of the Bowels—Enteritis Catarrhalis Acuta.

ETIOLOGY. *Acute catarrhal enteritis* may be either primary or secondary. The *primary form* of the disease is generally occasioned by errors of diet. It is not unfrequently observed after eating indigestible substances, or as a consequence of drinking foul water. It may result from chilling of the surface when overheated; or as a consequence of wounds, or injuries, or foreign bodies, or parasites in the intestinal canal. It may result from the introduction of poisonous substances, or from the excessive use of cathartics.

Secondary catarrhal enteritis results, in many cases, from the extension of gastric inflammation into the intestinal canal, or as a consequence of peritonitis. Rectal inflammation is, sometimes, excited by infective secretions from the vagina, or by eczema surrounding the anus.

In many cases the disease is originated by obstruction in the course of the circulation that is produced by disorders of the liver or of the intra-thoracic organs. It may also be observed as a consequence of consumption, syphilis, chronic nephritis, and other cachectic conditions. Frequently it occurs during the course of infective diseases, such as typhoid fever, etc. Extensive burns or scalds are frequently followed by acute enteritis, and by the formation of round ulcers in the duodenum which are identical in nature and origin with the round ulcers of the stomach. They are usually located above the orifice of the common bile-duct, in the portion of the intestine which is bathed with gastric juice from the stomach.

PATHOLOGICAL ANATOMY. The *mucous membrane* of the intestine is red and swelled. Local *extravasations* of *blood* are frequently visible under the epithelial surface. The *muscular* and *serous coats* of the *intestine* remain without change, excepting in very severe cases. The *solitary* and *agminated lymph glands* are enlarged and prominent, and are surrounded by a zone of dilated capillary vessels which forms a highly colored areola. The *mesenteric lymph glands* are also enlarged and succulent. Occasionally the *epithelial surface* appears slightly

led, and points of ulceration may be discovered, which, sometimes, e their origin in the glandular structures, but, sometimes, affect the r-glandular tissue alone.

YMPTOMS. The symptoms of *acute catarrhal enteritis* are not uni- n, but are somewhat modified according to the locality of the inflam- ory process. The *ileum* and the *colon* are usually associated in disorder, and furnish the most conspicuous symptoms, of which the f is *diarrhœa*. The bowels are evacuated many times a day, though aggregate amount of fecal discharge may not greatly exceed the ıral quantity. The stools are more or less fluid, in consequence of r rapid passage through the intestines without sufficient time for r concentration. There is, frequently, an excessive transudation iquid from the distended bloodvessels of the intestinal canal.

The *stools* are yellow, green, slimy, sometimes tinged with blood, and tain masses of undigested food, parasites, etc. After a time, they ome colorless, watery, and turbid with flakes of detached epithelium, embling rice-water in appearance. Fecal odor disappears.

The *abdomen* is sometimes distended with gas, but it is often some- at retracted. The peristaltic movements of the intestines can be dily distinguished through the abdominal wall, and are accompanied gurgling sounds and colicky sensations. The *urine* is usually inished, and, in severe cases, may be completely suppressed. It is ghly concentrated, and frequently occasions a burning sensation in e urethra.

Febrile symptoms are frequently absent, but sometimes there is con- lerable elevation of temperature which may persist for a number of ys, rendering the diagnosis doubtful between enteritis and typhoid fever.

Thirst is increased. The *appetite* is generally diminished, though, metimes, it is retained if only the lower portion of the bowels be volved. The disease may last for one or two days, or it may con- nue for many weeks. Sometimes it terminates in collapse and death.

When acute inflammation involves only the *upper portion* of the testine the bowels may remain constipated in consequence of the sorption of the liquid portion of the feces as they pass through the althy colon. The principal symptoms are of a colicky character. undice is not unfrequently present, by reason of an inflammatory struction of the common bile-duct.

Inflammation of the *cæcum* and *vermiform appendix* are not uncom- on as a consequence of irritation by foreign bodies. The principal mptoms are pain, swelling, and dulness on percussion in the right ac fossa.

Catarrhal inflammation of the *rectum* (proctitis catarrhalis) is indi- ted by tenesmus, and by the frequent passage of small quantities of my and bloody matter, with a certain amount of tenderness on pres- re in the left iliac region. The anus is strongly retracted, and hibits spasmodic movements of the sphincter. The mucous mem- ane of the rectum is hot and swollen, and is covered with an exces- e amount of bloody mucus. In chronic cases the sphincter becomes ralyzed, and the irritating contents of the bowels continually trickle rough the anus, and produce excoriation of the adjacent surfaces.

DIAGNOSIS AND PROGNOSIS. Acute catarrhal enteritis can hardly be mistaken for anything but *typhoid fever* in febrile cases; or *cholera*, when that disease is prevalent. From the last it may be distinguished by the absence of comma bacilli in the stools; and from the first, by the course of the temperature, and by the absence of roseola and typhoid bacilli. The prognosis is favorable, unless complicated by other incurable diseases.

TREATMENT. The patient must remain in bed and the abdomen should be covered with warm flax-seed meal poultices. The diet should be restricted to gruel and mutton broth. Boiled water and a little red wine may be allowed for a drink. If the attack has been preceded by constipation of the bowels or by errors in diet, a tablespoonful or two of castor oil may be given in the froth of beer, to conceal its taste. Children take it readily with a little milk in which a stick of cinnamon has been boiled. If oil is objectionable, the bowels may be evacuated with a small dose of calomel and jalap (calomel., pulv. jalap., āā gr. v). If the diarrhœa does not readily subside, Dover's powder may be given in doses of five grains every three hours; or the subnitrate, or salicylate, of bismuth, in ten-grain doses, with half a grain of powdered opium, every three hours. If the disease tends to become chronic in the lower bowel, it is well to employ a daily irrigation of the colon, with the aid of a fountain syringe and rectal catheter. The intestine may be thus thoroughly washed out and then injected with a very weak solution of nitrate of silver (1 : 5000).

Tenesmus may be relieved by suppositories of morphine and belladonna (morph. sulph., gr. $\frac{1}{3}$, ext. belladon., gr. $\frac{1}{4}$, olei coco., q. s. Ft. suppositorium no. i).

Acute Infantile Gastro-enteritis—Gastro-enteritis Acuta Catarrhalis Infantum.

ETIOLOGY. During hot weather the children in large cities are extremely liable to acute inflammation of the stomach and intestines, that is caused by improper diet, insufficient clothing during sudden changes of weather, chilling of the surface when overheated, filth, overcrowding, and the miasm which pervades densely populated and ill-drained quarters. In addition to these causes, many infants are deprived of proper nourishment in consequence of the debility, illness, or death of their mothers. The infantile stomach is, moreover, predisposed to disease in consequence of its incomplete development, by reason of which it is unfitted for anything but food of the normal quality and quantity. The processes of weaning and dentition are, also, attended with danger because of the difficulties that accompany the use of food to which the child is imperfectly adapted, and by reason of the general disturbance which frequently attends the eruption of the teeth.

PATHOLOGICAL ANATOMY. The anatomical changes which accompany infantile diarrhœa do not essentially differ from those which have been already described.

SYMPTOMS AND DIAGNOSIS. The attack commences with *vomiting*

diarrhœa by which the contents of the alimentary canal are cuated. Sometimes the little patient passes rapidly into a condition collapse, and death follows, although the active manifestations of the ase have previously subsided. Under ordinary circumstances, ever, the bowels continue to be moved about once every two hours. stools are, at first, slimy, and yellow or green, or they assume color after exposure to the air. Gradually they become trans- ned into a dirty, watery liquid which contain masses of curdled and flakes of mucus that are sometimes stained with blood. The ls lose their offensive odor and become transformed into a rice- er liquid which scarcely stains the diaper.

The separate discharges are preceded by *colicky pain*, during which infant cries and draws up its knees against the belly, seeming to ain relief from their pressure. The *abdomen* may be either dis- ded or it may be considerably collapsed. The *anus* is surrounded a broad, red ring of eczema intertrigo. Sometimes there is *prolapse the rectum*. The *urine* is greatly diminished or entirely suppressed. ere is great *thirst*, and the child nurses or drinks eagerly, but ually vomits everything that is taken. The *mouth* is dry and hot, d often exhibits patches of thrush or aphtha. The *breath* exhales acid or offensive smell. Symptoms of *collapse* usually appear in e course of twenty-four or forty-eight hours. The extremities come cold, emaciation is extreme, the eyes sink in their sockets, e countenance assumes an aged and careworn expression, the fonta- lles become greatly depressed, and in very young children the cranial nes may overlap one another. Catarrhal inflammation attacks the *njunctiva;* the *cornea* is sometimes perforated by ulceration. Symp- ms of *cerebral anæmia* appear in the form of dyspnœa, spasms, lirium, convulsions, coma, and death.

Prognosis and Treatment. The prognosis is always very grave. holera infantum is an exceedingly dangerous disease.

Of the greatest importance is prophylactic treatment in all cases of tificial feeding, weaning, and dentition. All women are not fitted to rse their children; young girls of less than eighteen years, chlorotic d consumptive mothers, or the victims of nervous disease and syphilis, ould not be allowed to act as nurses. Healthy women should be structed during the later weeks of pregnancy to bathe their nipples ith cologne-water or whiskey, and should rub them with a piece of ft flannel, in order to prevent the danger of fissures and ulceration ring the period of lactation. The babe should be nursed at regular tervals, every two hours during the first month of life; afterward ery three hours during the day. Its mouth should be carefully shed after nursing, in order to prevent fermentation of milk within cavity, by which indigestion and diarrhœa might be excited. The other's diet must be sufficiently abundant without the use of vegeta- es and acids. Renewed pregnancy must be the signal for weaning e child, since the mother's milk will then become deficient in triment.

If it be necessary to employ a wet-nurse, the utmost caution must be ercised in the selection of a healthy woman who is free from syphilis.

A mother who has given birth to other children should be preferred, because of her superior skill in the management of infants, and her own child should not differ more than one or two months in age from the nursling.

If it be necessary to resort to artificial feeding, cow's milk affords the best substitute for mother's milk, though ass's milk and goat's milk are theoretically preferable. Milk should be procured from a healthy cow, especially from one that is free from every symptom of tuberculosis. The animal should be stall-fed with hay, oats, meal, and similar food. Green food is objectionable, since its use often exercises through the milk a laxative effect upon the infant.

The milk should be heated to 200° F. as soon as it is obtained, and should be neutralized with one or two tablespoonfuls of lime-water, or a small quantity of bicarbonate of sodium. A convenient sterilizing apparatus for the preparation and storage of milk may be very readily obtained from any dealer in medical and surgical supplies. The nursing-bottle must be kept scrupulously clean, and empty when not in use. During the first month of infantile life the milk should be diluted with an equal part of warm water which has been previously boiled. With each successive month the quantity of water may be diminished by one-fifth, until pure milk is reached. It should be given at the temperature of the body, after it has been sweetened with milk-sugar, if that can be obtained, or otherwise with common white sugar; a very little salt may also be added to the mixture. Artificial substitutes for milk should, if possible, be avoided, since their use predisposes the infant to rickets and allied disease.

At the end of the ninth month a healthy child may be prepared for weaning, though it is well to delay until the summer is passed, and to avoid a time when the eruption of teeth may be expected. The milk should be mixed with an increasing quantity of thin broth, which, after a while, may be reinforced with the white of an egg, and the child may be gradually accustomed to finely minced meat, and to a little stale bread, with thin cocoa for a drink.

If, in spite of all these precautions, the infant be attacked with diarrhœa, the ordinary food must be withdrawn, and the child may be allowed to take in teaspoonful doses water that has been boiled and cooled and mixed with the white of a fresh egg in the proportion of one egg to a half-pint of water. A small quantity of salt should be dissolved in the water, and, if the patient seem exhausted, a teaspoonful of brandy, or a corresponding quantity of good wine, may be added. Thin arrowroot, sago, and cream are sometimes agreeable articles of diet; mutton-broth and beef-tea, made by expression of the juice from minced meat that has been soaked in an equal quantity of hot water, may be allowed.

For the relief of vomiting and diarrhœa, calomel should be given until the stools become slimy and bilious:

℞.—Calomel. gr. j.
Sacch. lact. gr. x.—M.
F. pulv. no. x. S.—One every hour.

This may be followed by a neutralizing cordial, in doses of ten to
ten drops every hour. With the subsidence of acute symptoms,
ourse may be had to astringents:

℞.—Tr. krameriæ } ãâ ℥ss.—M.
Syr. rhei aromat. }

S.—Fifteen drops every two hours.

bismuth—

℞.—Bismuth. subnitrat. gr. ij.
S.—Every three hours.

ates should be avoided, since a fatal result often follows their admin-
ation to young children.

Convalesence is, frequently, very rapid, and requires little medicine,
proper diet can be procured. Change of air from the city to the
ntry, or to the seaside, or to the great lakes, is attended with the
piest results.

Chronic Catarrhal Inflammation of the Bowels—Enteritis Catarrhalis Chronica.

Etiology. *Chronic catarrhal inflammation* of the *bowels* may
ult from an acute inflammation, or it may gradually invade the
estines as a consequence of progressive obstruction in the course of
abdominal circulation. It is, not uncommonly, associated with
neral cachetic conditions and tubercular or malarial infection. In
tain localities infusorial parasites act as an exciting cause of the
ease.

Pathological Anatomy. The *mucous membrane* is dark and
id, sometimes, in chronic cases, of a slate color, produced by the deposit
blood-pigment in the tissue. This is most abundant in the villi and
ound the circumference of the lymph follicles. These glands are,
ually, considerably enlarged, and the entire mucous membrane, with
submucous connective tissue, is greatly thickened. In severe cases
whole thickness of the intestinal wall participates in the hyperplastic
cess. The surface of the membrane is covered with a slimy or,
metimes, puriform liquid. The mucous membrane is eroded and
erated. The *ulcers* are, at first, rounded, but finally assume an
gular form with undermined borders; polypous growths are not
ommon in their vicinity. Not unfrequently the surface of the ulcer
ds pus; and, sometimes, large vessels become eroded and bleed. In
er cases, *perforation* and *peritonitis* occur. Sometimes the danger
perforation is obviated by the formation of adhesions between the
toneal base of the ulcer and a neighboring peritoneal surface.
Circumscribed abscess may thus be formed. It sometimes attains to
idable dimensions, and may be evacuated through any one of the
cent cavities or passages.

In favorable cases the ulcer heals by cicatrization; but this process
originate new dangers by constriction of the intestinal canal.

Follicular ulcers originate in the lymph follicles of the intestines,

and are usually situated in the colon, which sometimes appears completely riddled by their multiplicity. The process of ulceration is indicated by swelling and multiplication of the glandular cells, which then undergo degeneration and necrosis as a consequence of mutual pressure. The cavity that is thus formed rapidly enlarges by ulceration of the surrounding mucous tissue. The undermined walls and ulcerated cavities frequently contain translucent, jelly-like masses, resembling sago grains, which are frequently voided with the stools. The subsequent course and results of follicular ulceration correspond with the similar conditions which have been previously described.

Symptoms and Diagnosis. The bowels are usually *constipated* or *irregular* in their action, being alternately either *confined* or *loosened*. Sometimes diarrhœa is manifested only on arising in the morning, when two or three loose passages occur, without subsequent evacuation until the next morning. In many instances, undigested food mixed with pus or sago grains may be observed in the stools. Sometimes blood appears in small quantity. Microscopical examination indicates the exact character of the evacuations, and may render evident the eggs of parasites, or infusoria.

In certain cases, *casts*, or *voluminous shreds* of *fibrillated mucus*, which appear like fragments of detached mucous membrane, are evacuated from the bowels (enteritis membranacea). Such discharges sometimes recur at stated intervals with considerable regularity. They are usually observed during middle life, especially in women with blue eyes, fair complexion, and a nervous temperament.

Flatulence, *gurgling*, and *colicky pain* are frequent occurrences in chronic catarrhal inflammation of the bowels. Sometimes *palpitation* of the *heart*, *subjective dyspnœa*, and *headache* accompany the disease. If the stomach is also involved, the symptoms of *chronic gastritis* are present.

Progressive *emaciation* and *exhaustion* are gradually developed. The patient becomes *hypochondriacal* and liable to *mental disorder*. The *blood* is reduced in quantity, and its *circulation* is so enfeebled that the surface of the body becomes cool and pale, and the extremities remain cold.

The duration of the disease covers many months or years. Death results from cardiac failure, or from intercurrent diseases.

Prognosis and Treatment. Chronic catarrhal inflammation of the bowels is a very obstinate disease, and its prognosis is rather unfavorable, on account of the difficulty with which patients can be subjected to radical treatment at a sufficiently early period.

When constipation exists, the bowels should be relieved by the daily use of compound rhubarb pills, or compound licorice powder, or podophyllin in doses of one-quarter of a grain, or tamarind laxatives. Glycerin suppositories sometimes produce a good effect: and mineral waters, such as Saratoga spring water, Hunyadi-János water, Friedrichshall and Seidlitz waters, may be taken with great benefit on arising in the morning. Massage, and the application of the faradic current to the walls of the abdomen are of great service.

Chronic catarrhal inflammation that is accompanied by diarrhœa

st be treated in accordance with the rules which have been given for management of the acute form of the disease.

ammation of the Cæcum and Vermiform Appendix—Typhlitis, Peri- et Paratyphlitis.

ETIOLOGY. The inflammations of the cæcum and vermiform appendix are described under the name *typhlitis;* while inflammation of peritoneum which surrounds that portion of the bowel is called *rityphlitis;* and inflammation of the connective tissue behind the cum is known as *paratyphlitis.* Such inflammations are generally used by coprostasis, or by foreign bodies, such as seeds, stones, etc., d by ulcers which have been formed upon the mucous membrane. metimes the process thus excited is restricted to the vermiform appendix.

Paratyphlitis and perityphlitis are usually excited as a secondary nsequence of inflammations either within the bowel or in the neighring organs. They sometimes occur in connection with infective seases, and are more frequently encountered among men than among omen, especially during early adult life.

SYMPTOMS. The different forms of inflammation which affect the ecum and its environment agree in the common symptoms of pain d swelling in the right iliac fossa. They sometimes commence indiously, but often originate suddenly. There is complaint of intolerble pain in the right iliac fossa, that is increased by all forms of ovement or pressure. The patient lies upon the right side, with the ck bent forward, and the right thigh drawn upward, so as to relax e abdominal wall. Examination of the abdomen discovers in the ght iliac region more or less swelling that is produced by a resistant mor of a long oval form, occupying the position of the cæcum and mmencement of the ascending colon. The abdomen is often disded with gas, the bowels are constipated, the urine is scanty, somees there is a high fever and a small, hard and rapid pulse. The ntenance indicates pain, and the eyes are sunken. Sleep is disbed, and the speech is reduced to a whisper. Hiccough is frequently rved, vomiting often occurs, and sometimes assumes a fecal char-r, and the breath is offensive. If the symptoms have been proed by fecal accumulation, they soon subside after evacuation of the els; but it often happens that chronic inflammation, ulceration, and trization produce lasting injury to the patient.

Inflammation of the vermiform appendix is usually attended by e acute symptoms. Fecal vomiting is absent; the tumor is usually ller than in fecal typhlitis; and perforation, followed by peritonitis, uently brings on a fatal termination; sometimes ulceration occurs, is followed by cicatrization. The orifice of the appendix may be s occluded, after which event the tube becomes distended with a us liquid (hydrops processus vermiformis).

n cases of *paratyphlitis* the tumor in the right iliac fossa is frently concealed by intestinal folds that are filled with air and mask dulness on percussion. Great pain is experienced, and it fre-

quently irradiates into the shoulder or into the right thigh. The right testicle is sometimes retracted, and painful passage of urine is experienced.

The products of inflammation are removed by absorption in favorable cases; but sometimes the exudation burrows behind the peritoneum into the vicinity of the kidney, or within the cavity of the pelvis, when the bladder, uterus, vagina, or rectum may be perforated. Sometimes the abdominal wall is thus penetrated, and pus escapes externally. In other cases the thoracic cavity may be reached. Not unfrequently a paratyphlitic abscess ruptures into the cæcum and is evacuated through the bowels.

Simple perityphlitis is characterized by the predominance of the symptoms of peritonitis. The iliac tumor lies very superficially, and is exceedingly sensitive. Suppuration may lead to the evacuation of pus externally, or to its escape into the internal organs. Large blood-vessels are sometimes thus eroded, and occasion dangerous internal hemorrhage. Intestinal obstruction by compression of the ileum, or as a consequence of inflammatory paralysis of its muscular coat, is not uncommon. An indurated tumor frequently remains for a long time after the subsidence of acute symptoms, and relapses frequently occur on slight provocation.

DIAGNOSIS. The diseases which may be mistaken for inflammation of the cæcum and its environment are: 1. *Coprostasis in the cæcum*, which may be recognized by the absence of inflammatory symptoms. 2. *Cancer of the intestine*, usually insidious in its development and course, and encountered among old people. 3. *Invagination*, which is indicated by a tumor, accompanied by a bloody and slimy diarrhœa. 4. *Wandering kidney*, which may be recognized by the renal form of the swelling; by its mobility; and sometimes by the pulsation of its artery. 5. *Biliary and renal colic*, characterized by intermittent pain and by the presence of icterus, or of hæmaturia. 6. *Psoas abscess and tuberculosis of the pelvic bones* may be recognized by the evidence of disease in the spinal column or pelvis. 7. *Psoitis*, indicated by pain in the right iliac fossa, but unattended by disturbances of the gastro-intestinal canal. 8. *Tubercular or cancerous diseases of the mesenteric or retro-peritoneal lymph glands*, characterized by multiple tumors of irregular form and changeable location.

PROGNOSIS. Typhlitis is less dangerous than the other forms of inflammation about the cæcum. All are attended with danger, especially if perforation should occur.

TREATMENT. In typhlitis that is dependent upon fecal accumulation, the intestine should be thoroughly irrigated, every hour, by the aid of a fountain syringe, until fecal evacuation takes place. This gives a better result than the use of purgatives, which are liable to excite inflammation. In cases of inflammation involving the appendix vermiformis, and in para- or peri-typhlitis, the patient must remain in bed with a large warm poultice over the abdomen, and must be placed under the influence of opium (half a grain every hour until the pupils become contracted). The diet must be restricted to liquids, and the opium treatment must be continued for weeks, if necessary. The colon

y be irrigated every day by the aid of a fountain syringe. Severe
n can often be promptly subdued by the application of several leeches
r the seat of the tumor. In cases of tardy absorption of the
ducts of inflammation, mercurial ointment may be gently rubbed
o the skin over the region of swelling. If fluctuation be detected,
early incision should be performed.

Intestinal Cancer—Carcinoma Intestinale.

Pathological Anatomy. *Intestinal cancer* usually occurs as a imary disease. In the majority of cases it is developed in the rectum ar its junction with the sigmoid flexure, and in the other convolu- ons of the large intestine; but it is rarely discovered in the small testine. When that portion of the canal is invaded, it is usually the uodenum which becomes infiltrated. All the different varieties of can- erous disease are found in the intestine as well as in the stomach, and he general appearance of the neoplasm depends upon its histological tructure.

The disease manifests a tendency to encircle the intestinal canal, and hus to produce constriction or complete occlusion. Originating in the nucous membrane, the entire walls of the canal are finally infiltrated.

When the intestine has been constricted by cancerous infiltration, the portion of the canal above the stricture becomes dilated and filled with tagnant feces, while the portion below the stricture falls into a condition f collapse and innutrition. The mucous surface exhibits evidences of nflammation and ulceration. Sometimes actual rupture of the dilated portion takes place. Occasionally, portions of a soft cancerous growth re thrown off, and may be recognized in the feces; partial cicatrization nay also follow such an event.

The degeneration of a soft cancer is often followed by hemorrhage, or by rupture into the peritoneal cavity, or by the establishment of passages communicating with the bladder, or with the vagina, or with he adjacent loops of the intestine itself. Sometimes the abdominal wall may be perforated, or fecal abscesses may be formed behind the peritoneum. The lymph glands and neighboring organs may also become secondarily invaded by cancerous infiltration.

Symptoms. The symptoms of intestinal cancer are often exceedingly bscure. There may be complaint of *abdominal pain*, *irregularity* of he *bowels*, with alternating constipation and diarrhœa, gradual *emacia- ion*, and *death* from *exhaustion*, which is only explained after decease y the discovery of intestinal cancer.

Sometimes, *obstruction* of the *bowels* occurs suddenly, and is ex- lained by the lodgment of undigestible substances above the cancerous onstriction.

Cancerous infiltration of the *lower portion* of the *colon* is often shered in by an unendurable pain under the sacrum, resembling that f sciatica.

Abdominal exploration may be accomplished by external palpation, r by rectal examination, or by the combination of both methods. When a *tumor* can be distinguished through the abdominal wall, it gen-

erally presents an irregular, oval, or rounded form; it is generally sensitive and movable, but sometimes it cannot be displaced, especially if it be developed in the cæcum, or if it has become adherent to the adjacent surfaces. When the transverse colon or other loops of the intestine have been invaded, it is often exceedingly movable. For this reason the majority of intestinal cancers appear to lie below the level of the navel.

Rectal exploration is most useful in cases of *rectal cancer*, or when the *sigmoid flexure* is infiltrated. Under such circumstances, uneven, slimy, bloody, and ulcerated surfaces may often be detected, or scirrhous indurations may be clearly defined. So far as possible the exploration should be effected by the aid of the finger, since instrumental examination occasions great pain.

The *feces* exhibit considerable change in quantity, form, and constitution; in the majority of cases obstinate constipation is the rule. Sometimes the progress of ulceration brings relief when an obstructive mass breaks down.

The feces are sometimes flattened, ribbon-like, or reduced to small lumps, like sheep's dung. Sometimes, an excessive hemorrhage takes place, or the stools may contain muco-purulent masses mixed with cancerous fragments.

When the *duodenum* is invaded by a cancerous growth, persistent jaundice follows occlusion of the common bile-duct, and the symptoms of gastric and œsophageal dilatation may appear, if the lumen of the intestine be seriously obstructed.

Rectal cancer is not inconsistent with long preservation of the general health. Evacuation of the bowels, however, is attended with great pain, and sometimes assumes the form of diarrhœa. Hæmorrhoids are frequently developed, and must not be mistaken for cancerous masses.

The *duration* of intestinal cancer is about four years. Death frequently occurs as a result of progressive emaciation and exhaustion. The limbs become œdematous; sometimes thrombi obstruct the veins, and lead to a fatal result. In certain instances death is directly caused by secondary cancerous growths which involve the vital organs. In other cases, it is the consequence of intestinal occlusion or of perforation; it may be preceded by fecal abscess and pyæmic symptoms.

Diagnosis and Prognosis. Cancerous disease of the sigmoid flexure and rectum are the only forms of intestinal cancer which admit of easy recognition. Even when a tumor can be discovered through the abdominal wall, it is often impossible to decide whether it be connected with the pancreas, the liver, the lymph glands, the kidneys, the peritoneum, or the intestine. The prognosis is always unfavorable.

Treatment. The active treatment of intestinal cancer falls within the realm of surgery; but when the patient will not submit to operation, or when surgical interference is not indicated, the principal duty of the physician is limited to the prescription of a liquid diet consisting of milk and other animal food, together with opiates in quantity sufficient to relieve pain. Offensive discharges from the anus require the daily use of disinfectant injections.

mong other **intestinal tumors** have been described cases of lipoma, oma, myoma, sarcoma, and cystoma. *Polypous growths* sometimes in the *rectum*, especially among children who have suffered with rhœa. Such tumors frequently excite a chronic discharge of blood the rectum, and are sometimes extruded spontaneously through anus. A chronic or bloody diarrhœa in the case of a child should ays arouse suspicion of the existence of a polypus in the rectum.

Intussusception—Invagination.

ATHOLOGICAL ANATOMY. *Intussusception* consists in the entrance ne portion of the intestine within another. This sometimes takes e as a simple mechanical movement during the act of death, but in cases there are no evidences of inflammation.

n certain cases the lower portion of the intestine is pushed upward hin the superior portion of the loop, constituting an ascending or *ograde intussusception.* In the majority of cases, however, the er segment is received within the lower, thus constituting a de- nding or progressive intussusception. The invaginated portion is ed the *intussusceptum*, while the invaginating sheath is called the *ussuscipiens.* Besides the intussusceptum, a portion of the mesentery omes invaginated within the sheath; consequently, its traction causes lower orifice of the invaginated portion to present the appearance a longitudinal slit instead of a circular opening.

The neck of the invaginated portion tends to become more and more nstricted by the occurrence of inflammation, hence the portion of the estine above the stricture dilates, through the accumulation of feces, ich by their weight tend to crowd the intestine deeper into the vaginating sheath. In this way the intussusceptum may reach the us, and may even project through that opening.

As a consequence of the great disturbances of circulation that accom- ny the process of invagination and constriction, inflammation is tablished, so that the intussusceptum may become gangrenous, actually ughing off and being discharged through the anus. In this way it recorded that not less than ten feet of the intestine were discharged one instance. Such a process may be very readily accompanied by morrhage or by peritonitis or by inflammation of the intestine. If e be preserved, there is great danger of subsequent constriction of e intestine as a result of cicatrization.

Intussusception takes place more frequently in the ileo-cæcal por- n of the intestine than anywhere else. The ileum descends with cæcum into the colon, constituting *ileo-cæcal intussusception.* hen the ileum alone descends through the ileo-cæcal valve, it is med *ileo-colic intussusception.*

ETIOLOGY. About half the cases of intussusception occur during ancy and early childhood. It may be produced by falls or blows on the abdomen, or by constipation or diarrhœa. Occasionally it is sed by the weight of an intestinal tumor.

SYMPTOMS. *Intussusception* excites great *pain*, which, among chil- n, frequently induces convulsions. It is sometimes accompanied by

thin, slimy, and bloody stools. *Tenesmus* and *vomiting* are not uncommon. The abdomen becomes, after a time, sensitive to pressure and greatly distended. Frequently a firm, elastic, smooth, and sausage-like mass can be felt in the neighborhood of the right iliac fossa, extending toward the navel or across the entire width of the belly. Frequently the anus remains gaping open and oozing with slimy stools. With the finger in the rectum, it is frequently possible to feel the invaginated mass. Replacement of the intussusceptum is followed by the speedy recovery of the patient; but, unfortunately, relapses are very common.

In severe cases the diarrhœa which marks the commencement of invagination is followed by the symptoms of complete *obstruction of the intestine* and cessation of the discharge. Evidences of *peritonitis* usually appear, and death is preceded by complete *collapse*, or by the *convulsions* which indicate *cerebral anæmia*.

Sometimes the separation and evacuation of an intussusceptum effects a spontaneous cure. This event usually takes place during the later part of the second week, or during the third week after the commencement of the disease.

Diagnosis. The diagnosis generally presents no difficulty and is based upon the symptoms that have been described. The differential diagnosis may lie between an intussusceptum and a rectal polypus, but the decision should not be difficult.

Prognosis. About seventy per cent. of the cases of intussusception prove fatal.

Treatment. Intestinal insussusception requires the administration of large doses of opium (half a grain every hour until the pupils become contracted). Infants may be given one or two drops of the tincture of opium every hour, so long as it can be tolerated. Three or four times a day the lower bowel should be filled with tepid water from a fountain syringe. But, when the case has continued for any length of time, great caution should be exercised in the use of injections for fear of rupture of the intestinal wall. Inflation of the colon with gas has been attempted by the aid of a bellows and rectal tube, or by the liberation of carbonic acid gas above the sigmoid flexure, but this operation has been followed, sometimes, by intestinal rupture. If the tumor can be reached through the anus, an effort should be made to replace it by the aid of a bougie. The question of abdominal section for the relief of intussusception may arise; but, hitherto, the results of the operation have not been encouraging.

Intestinal Constriction and Occlusion—Enterostenosis et Ileus.

Etiology. Constriction or occlusion of the intestine may result either from changes in the contents of the alimentary canal, or from alterations in the structure of its wall, or in the condition of neighboring organs. They may be produced by *coprostasis*, when the cavity of the intestine is occupied by hardened fecal matters. In other cases *foreign bodies*, *e. g.*, gall-stones, enteroliths, parasites, and insoluble substances which have been swallowed may obstruct the lumen of the canal.

The growth of *tumors* in the intestinal wall and the development of *stricial indurations* may obstruct the passage. In this way syphilitic cesses and hæmorrhoids may constrict the rectum. *Obstinate con-ation* which has been produced by nervous disorders may lead to truction. In like manner, *injuries* of the abdomen, *inflammation* owing the reduction of a hernial tumor, intussusception, or twisting the gut may result in occlusion of the bowel.

Obstruction may sometimes be produced by *internal hernia*, as when oop of the intestine finds its way through an abnormal opening in mesentery or the suspensory ligament of the liver, or the round aments of the uterus, or is pushed through the foramen of Winslow. ter *peritonitis* loops of intestine are sometimes incarcerated by the nds of adhesion which have been thus formed.

Among the diseases of neighboring organs by which the intestine ay be constricted or occluded, must be mentioned *tumors* involving e pelvic and other abdominal organs, *wandering kidneys*, *peritoneal udations*, and *fecal accumulations* which, by their pressure, may nstrict portions of the intestinal canal.

The disease occurs more frequently among men than among women; l ages are liable to its incidence; it is more frequently encountered mong Russians than among other Europeans, in consequence of the reater length of the Russian intestine.

Pathological Anatomy. Above the point of constriction the ntestine becomes dilated, while the lower portion presents a collapsed ppearance. Duodenal constriction leads to dilatation of the stomach nd œsophagus. In chronic cases the intestinal wall becomes thick-ned, and its muscular layer exhibits considerable increase. Tissue egeneration and rupture may finally occur, however, in chronic cases. he mucous membrane of the dilated portion is inflamed and often lcerated through mechanical irritation by scybalous feces. Peritonitis a not uncommon event, especially after perforation. If vomiting ccur it may lead to pneumonia through the intrusion of vomited matters nto the trachea and bronchi.

Occlusion, as a consequence of torsion, usually occurs in the neigh-orhood of the sigmoid flexure.

Symptoms. The symptoms of intestinal constriction are frequently haracterized by extraordinary *difficulty in voiding the stools*, especially the diet has been composed largely of vegetable substances. In many ases, however, there is a *chronic diarrhœa* that is produced by inflam-ation of the intestine above the point of stricture. This is often bserved in syphilitic or cancerous strictures of the rectum. The feces e frequently flattened and ribbon-like, or resemble sheep's dung. efecation is usually attended with great pain, especially when the wer part of the colon or the rectum are involved. *Hæmorrhoids*, in ch cases, are exceedingly common. The abdomen is usually distended ith gas and feces. Sometimes active peristalsis is apparent, and rgling sounds are audible in the gut.

Careful examination through the rectum and the vagina should never neglected. Constrictions of the small intestine lie in the region tween the navel and the pubes. Obstructions of the colon are seated

either in the lateral portions of the abdomen or above the navel. Obstructions which are produced by diseases of the pelvic organs can be frequently discovered through the vagina. Rectal examination by the introduction of the whole hand under chloroform should seldom be attempted, by reason of the danger of rupture which has been, in several instances, thus produced.

Complete occlusion of the intestine has been described under several titles, viz., Ileus, Miserere, Passio-iliaca, Volvulus. Of these the first is the most ancient and convenient.

Ileus is indicated by three principal symptoms: absence of defecation, arrest of flatus, and the occurrence of fecal vomiting. The explanation of the first and second symptoms is obvious. The vomited matters consist of partly digested food, granular detritus, fungous parasites, and fecal masses, which at first present a normal appearance, but which, after a time, are reduced to a thin, watery, offensive liquid. The abdomen becomes distended with intestinal gases; peristaltic movements are frequently visible; and loud borborygmi are distinctly audible. Sometimes dulness and resistance like that of a tumor can be distinguished. The urine is greatly reduced in amount, and contains indican when the small intestine is occluded, because indol is then absorbed from the upper intestine and is excreted through the kidneys in the form of indican.

The patient rapidly passes into a condition of collapse. The temperature is sometimes increased, but it is often subnormal. The pulse is usually small and rapid. Death sometimes occurs within a short time, as if by shock. In other cases, though rarely, life is prolonged in a state of misery for many weeks. The fatal termination may sometimes occur suddenly, as a consequence of suffocation through the entrance of vomited matters into the respiratory passages. Intestinal rupture and peritonitis may be developed and prove fatal. Occasionally, the abdominal wall is perforated, and thus a contra-natural anus is formed, or a loop of the intestine above the point of constriction may become adherent to the loop below the obstruction, and by perforation at the point of adhesion relief may be obtained. In other instances, perforation may evacuate the intestine into the peritoneal cavity, or into other cavities or organs of the body. Fecal abscess and pyæmia may also be developed. In rare instances, a spontaneous recovery takes place through the evacuation of foreign bodies or other obstructing masses.

Diagnosis. The location of the intestinal obstruction is not always easy to discover. The indications derived from the presence or absence of indican in the urine are only decisive in the absence of peritonitis or cancer, both of which diseases cause its increase.

It must not be forgotten that in spite of every indication of ileus, post-mortem examination of the body sometimes fails to reveal any apparent cause of intestinal obstruction. Similar appearances sometimes follow arsenical poisoning, and may be occasionally observed in cholera or in peritonitis.

Prognosis. The prognosis is always grave, yet not hopeless.

Treatment. In all cases of simple intestinal constriction a liquid diet must be prescribed, and the bowels should be kept open with laxa-

or mineral waters. Obstructions which involve the pelvic organs be frequently removed by appropriate surgical operations. When symptom of complete occlusion arises, careful search should be e for the existence of hernial incarceration or strangulation; cially should this be remembered in the case of women, who some- s present an unsuspected femoral hernia. Coprostasis should be ted by frequent flushing of the colon with warm water, and by the inistration of the compound infusion of senna with Epsom salts or on oil. In certain cases it becomes necessary to dig out the im- ed feces from the rectum with the aid of a spoon before the tube syringe can be introduced.

When the seat of obstruction cannot be reached through the rectum he vagina, especially if torsion of the intestine be suspected, ab- inal section should be undertaken. Many surgeons prefer the ation of enterotomy; but in any case the knife should be used as y as possible, for the chances of recovery are rapidly diminished delay.

f surgical interference be out of the question, large doses of opium lf a grain every hour until the occurrence of pupillary contraction) st be employed, and purgatives must be positively forbidden. Some- es a favorable result has been attended by frequent irrigation of the mach with the aid of the gastric syphon. The operation should be eated three or four times a day, and, if unsuccessful as a means of e, will nevertheless add greatly to the comfort of the patient by shing out the stomach and upper bowel. The lower bowel should also washed out frequently with water, and be pumped full of air.

Puncture of the distended loops of the intestine with a fine trocar s been often followed by great relief, and has sometimes resulted in re. Occasionally faradization of the intestine has been followed by ief and cure; one electrode should be placed in the rectum, while e other is moved about over the abdominal surface. In desperate es recourse may be had to the administration of metallic mercury, ich should be given in almost any quantity up to two pounds by ight.

Hæmorrhoids—Phlebectasia Hæmorrhoidalis.

Etiology. The causes of *hæmorrhoids* may be purely local, as in es of obstinate constipation, when the veins of the rectum are per- tently compressed by fecal masses. In other cases *catarrhal inflam- tion* of the *rectum* is the occasion of hæmorrhoids. *Cancerous* and er *strictures* of the *rectum* are also frequently accompanied by morrhoidal dilatation of the rectal veins.

In certain instances *diseases* of the *uterus*, *ovaries*, or *prostate gland*, press the hæmorrhoidal veins and produce piles. The same event ery common during the course of *pregnancy*. In like manner the stence of *obstruction* in the *portal circulation*, or in the *thoracic ans*, may produce blood-stasis and hæmorrhoidal distention in the tum.

The disease is very common among corpulent, plethoric people who and drink excessively, especially if, at the same time, they are

accustomed to sedentary habits. For these reasons the disease is mos commonly observed during the later period of active life, among me rather than among women.

PATHOLOGICAL ANATOMY. Hæmorrhoids are either external or i ternal. They are *external*, when located below the sphincter a muscle; *internal*, when situated above that muscle. In many ca the anus is surrounded by a ring of tumors which consist of dila bloodvessels covered with a membranous investment. Sometimes varicose veins are widely separated from one another, constitut tumors of variable size. Sometimes the dilated veins become obstru by the formation of thrombi, which finally become organized and c a cure of the disease. In certain instances calcification of a throm takes place. Frequently the submucous tissues of the rectum be thickened, and a chronic catarrhal discharge of slimy or muco-pur liquid oozes from the mucous surface. Not unfrequently the conne tissue around the rectum becomes acutely inflamed, and abscesses which may rupture into the rectum, or externally, or in both direc producing an internal, an external, or a complete *rectal fistula*.

SYMPTOMS. The existence of *hæmorrhoids* usually produces i rectum a feeling of weight and pain, which is liable to be incr by over-eating, or by protracted sitting, or by excessive debau The act of defecation is followed by great pain, which may res faintness or convulsions. The dread of such pain leads to a retention of the feces, and consequent general discomfort. I tain cases the principal symptom is afforded by a chronic, discharge from the rectum, which is often attended by tenesmu frequent defecation, so that the disease may be mistaken for dys In other cases copious hemorrhage takes place, which usually a in the form of an oozing from the capillary vessels. Such a dis of blood frequently affords great relief to the feelings of disc and universal disorder by which it has been preceded. The amo discharge is rarely sufficient to produce any danger. When with the feces, the blood is not mixed with them, but lies up surface of the fecal cylinder, and presents very little change in since its source is so near the anus.

Much more serious consequences follow the prolapse and stra tion of internal hæmorrhoids. The varicose tumors descend t the sphincter ani muscle by which they are spasmodically grasp strangulated. This condition is productive of intense suffering. patient lies upon his side, with his knees drawn up against the in order to avoid, if possible, any movement of the strangulated If they cannot be replaced, they are liable to become gangreno to slough away, by which event a natural cure may be effected, the process is attended with considerable danger of pyæmia.

The duration of the disease is liable to great variations. attacks, dependent upon transient causes, are soon relieved, but cases are of life-long duration.

DIAGNOSIS AND PROGNOSIS. Hæmorrhoidal tumors are to b tinguished from *excessively developed cutaneous folds about the* which differ by the absence of the varicosity and blue color that

xistence of venous dilatation. From *condylomata* they may be guished by the absence of other indications of syphilis, and from *cancer* by the absence of cachexia, and by the distinctly venous itution of the tumors. The prognosis is usually very favorable.

EATMENT. In the treatment of hæmorrhoids prophylactic meas- are of great importance. The habits of life must be regulated ll excess of diet and luxury must be restrained. Patients who the habit of consuming large quantities of meat, wine, and beer d exchange these articles for vegetables, fruits, and milk. Suf- from chronic diseases of the liver or thoracic organs must be as far as possible to avoid the occurrence of blood-stasis. In all the bowels must be regularly relieved. For this purpose one or easpoonfuls of compound licorice powder may be taken every The old-fashioned confection of sulphur and cream of tartar is r very useful laxative. Mild forms of the disorder may be quite d by small doses, long continued, of sulphur and cream of tartar form of a tablet (℞. Lac. sulphur., gr. v, potass. bitart., gr. j, gr. x. M.). The water of the Karlsbad or Saratoga springs es a favorable effect upon the majority of patients who are ric and vigorous. Weakly and anæmic patients should make use ers containing iron as well as sulphur. Change of air and occupa- e beneficial in cases of chronic constipation dependent upon a ary life.

the local relief of painful hæmorrhoids, suppositories containing ine and belladonna, with butter of cocoa, are useful; also, the und gall ointment, reinforced with cocaine (gr. x to the ounce), an excellent application to external hæmorrhoidal tumors. The injection of cold water is frequently beneficial; though many ts obtain greater relief from similar injections of hot water. hemorrhage may be treated by astringent injections or supposi- in the rectum. Applications of ice are usually sufficient to any ordinary flow. If internal hæmorrhoids are prolapsed, the t should be placed in the knee-elbow position, with the shoulders erably lower than the hips, when, with the oiled finger, the tumor usually replaced. If any difficulty attend this operation, ether be administered, and forcible dilatation of the sphincter ani will y facilitate the reduction of the tumor. Great relief from pain peedy recovery follow this method of treatment in the vast ty of cases. If neglected hæmorrhoids have become gangrenous, eparation and discharge should be favored by the application of poultices and by the free use of disinfectants.

se patients who are subject to recurrent attacks of hæmorrhoids requently avoid much suffering by the application of half a dozen s around the anus whenever an attack is imminent.

the radical cure of hæmorrhoids, the internal administration of r's solution of arsenic has been recommended. Local injection h little hæmorrhoidal tumor with carbolic acid and glycerin drops of a 2:1 solution) is often practised. By this method sease may be temporarily cured, but relapses are almost inevi-

table. Complete extirpation by surgical methods affords the most lasting result, though relapses are even then not uncommon.

Intestinal Hemorrhage—Enterorrhagia.

ETIOLOGY. *Intestinal hemorrhage* occurs either as a consequence of an abnormal condition of the intestinal contents, or by reason of local diseases of the walls of the canal, or as a result of general and infective diseases.

Obstinate *constipation* frequently occasions hemorrhage by the accumulation of hardened masses of fecal matter in the intestinal canal. *Foreign bodies* and *caustic poisons* which have been swallowed may also irritate and lacerate the mucous membrane. Certain *parasites*, *e. g.*, Anchylostomum duodenale, Distomum hæmatobium, produce hemorrhage by their action upon the mucous membrane.

Among the local diseases by which hemorrhage can be produced are *ulcerations*, *traumatic injuries*, *severe inflammation*, and *neoplasms* which involve the mucous membrane. Hemorrhage is a common symptom in the course of *intestinal intussusception*. It may be also produced by any cause which seriously impedes the *portal circulation*, and is, consequently, not uncommon in chronic diseases of the *liver* and *intra-thoracic organs*. In certain instances hemorrhage is directly dependent upon *vascular disease*, *e. g.*, amyloid degeneration, embolic obstruction, or aneurismal dilatation of the bloodvessels.

Intestinal hemorrhage is frequently observed in the course of *infective diseases*, especially those which, like typhoid fever, dysentery, and syphilis, are accompanied by intestinal ulceration. *Malarial fever* is sometimes accompanied by hemorrhage which is dependent upon obstruction of the hepatic vessels by the deposit of melanin. It frequently occurs in the course of other infective diseases, when hemorrhagic conditions are developed. In like manner it is a common occurrence in *scurvy*, *purpura*, *hæmophilia*, *uræmia*, and *cholæmia*.

PATHOLOGICAL ANATOMY. The whole length of the intestinal canal is sometimes occupied by dark clots of blood. In other cases the effused liquid exhibits a brownish, flocculent appearance like the grounds of beef-tea. In certain cases the clots are condensed and dried into hard and carbonaceous masses; in others the intestinal fluids resemble water in which raw meat has been washed, and contain flakes of mucus and pus. Sometimes ulcerated surfaces are visible upon which the source of hemorrhage can be distinguished. In other instances it is evident that capillary oozing has been the only source of the effusion. After repeated hemorrhages the other organs generally manifest the appearances of fatty degeneration, which is the direct consequence of an insufficient supply of oxygen through the blood.

SYMPTOMS. In certain cases *intestinal hemorrhage* is followed by rapid and complete collapse without the external appearance of any blood. This sometimes happens in cases of typhoid fever, which may thus result fatally in a very brief period of time. But the presence of blood in the stools is observed in the vast majority of cases. The nearer its source to the lower extremity of the bowels, the brighter the

or of the blood. When it has been discharged into the upper portion of the intestines, the color is dark or completely black, and the stool may be very offensive. Hæmatemesis occurs only when the seat of the hemorrhage is located in the duodenum. Sometimes, as in other cases of internal hemorrhage, the patient is conscious of a sensation of warmth and trickling, by which the locality of the hemorrhage is indicated. In severe or continuous cases the evidences of impoverishment of the blood are developed. The extremities become œdematous, and the urine exhibits traces of albuminuria, both of which are consequences of anæmia.

Diagnosis. In certain cases of obstinate constipation, the feces present a dark color which may be mistaken for blood; an excess of bile in the stools may produce a similar appearance. The juices of certain fruits, and medicinal substances, like hæmatoxylin, may discolor the stools; the dark color which follows the use of iron and bismuth is produced by the formation of their metallic sulphides in the alimentary canal. By stirring the feces with water the liquid is stained with blood, if any be present; in doubtful cases the aid of the microscope, or of the spectroscope, may be invoked. The previous history of the patient will readily determine the presence in the stools of blood which has been derived from the mouth, nose, œsophagus, respiratory passages, or stomach. Infants sometimes void blood which has been derived from a bleeding nipple, or from the maternal passages. The source of hemorrhage can usually be easily discovered when the rectum or the lower part of the bowels is involved; in such cases, the quality of the blood and its deposition upon normal fecal masses, indicate a source in the large intestine. Thin serous discharges that resemble the washings of raw meat occur in the course of dysentery. Black, tarry discharges may be referred to the duodenum, especially if they have been preceded by burns or scalds upon the external surface of the body.

Prognosis. The prognosis is dependent upon the cause and amount of the hemorrhage. In certain cases it is not without benefit to the patient, as may be observed when a moderate hemorrhage occurs during the course of typhoid fever that is accompanied by high temperature and cerebral symptoms.

Treatment. The general treatment must be based upon the predisposing causes of hemorrhage. Absolute rest in the horizontal position, and a light and cooling diet, must be prescribed. An ice-bag should be placed as near as possible to the seat of hemorrhage. Hypodermic injections of ergotine should be given, and five to ten drops of liquor ferri perchloridi may be taken, in water, every two hours. Excessive movement of the bowels should be quieted by half-grain doses of opium, repeated every hour until pupillary contraction is apparent. Hemorrhage from the rectum and large intestine may be controlled by injections of cold water, to which astringents may be added. Malarial hemorrhages require the administration of quinine in large doses (15 to 30 grains). If the patient pass into a state of collapse, alcoholic stimulants and musk (4 grains every hour) must be given. Hypodermic injections of camphor (camphor, 3 grains, almond oil, half a drachm) may

be administered three times a day. During convalescence, iron, arsenic, tonics, and good diet will be required.

Melæna Neonatorum.

The term melæna is applied to those cases of newborn children which are characterized by vomiting and purging of blood, that is not the result of accidental swallowing of blood in the acts of birth or of nursing. Such hemorrhage may be sometimes traced to definite causes of a traumatic character, or may be dependent upon an unhealthy condition of the mother, by which the nutrition of the fœtus was impaired. Local, vascular changes connected with cicatrization of the umbilicus are sometimes assigned as the cause of hemorrhage. In other cases it is thought to be the consequence of puerperal infection from the mother; while, in many cases, no special cause can be discovered. The occurrence of hemorrhage is usually observed before the third day of infantile life. Collapse and a fatal termination may speedily follow; and, in cases of recovery, the evidences of debility are sometimes of life-long duration. A fatal result is witnessed in about one-half of the cases. The treatment must be conducted in accordance with the rules laid down for the management of intestinal hemorrhage, having due regard to the age of the patient. At the time of delivery the umbilical cord should not be divided before it has ceased to pulsate. If the mother be attacked by puerperal fever, the infant should be removed, for fear of infection.

Colic—Enteralgia.

Colic is a term applied to all cases of intestinal pain which occur independently of any anatomical change in the alimentary canal. It may be produced by coprostasis, by foreign bodies, parasites, gall-stones, or by undigested and fermenting food. Certain persons always experience an attack of colic after the ingestion of particular articles of diet. Fermenting substances, which liberate large quantities of gas within the intestines, are very common causes of pain. The effects of lead and copper, and the irritating quality of many purgative remedies are well known. Certain nervous diseases, such as hypochondria, hysteria, neurasthenia, and tabes dorsalis are not unfrequently attended by paroxysms of severe colic. It is also often associated with diseases of the abdomen and pelvic organs. It is, moreover, a common consequence of exposure to malaria, or to sudden cold when overheated, especially among arthritic patients.

Symptoms. The prominent symptom is *pain*, of a griping and spasmodic character, which is referred particularly to the region of the navel, whence it radiates in every direction. It may be accompanied by gurgling in the bowels, which are frequently distended and prominent. The pain is, frequently, remittent and paroxysmal, and may be, in many cases, quite intolerable. It is often diminished by pressure, so that the patient instinctively compresses the belly with his hands or throws himself upon his face over a hard pillow. In other cases, however, a concurrent *cutaneous neuralgia* renders the abdomen tender

ıl on pressure. Fever, however, is absent. In many cases sm subsides rapidly after the evacuation of gas, or after a of the bowels. *Death* rarely occurs, though it has been ob- onnection with rupture of the intestines, or as a consequence ons excited by the severity of the pain.

ıis and Prognosis. The differential diagnosis lies between l) *Rheumatism of the abdominal muscles*, an affection which onger, is more variable in its seat, and lacks the paroxysmal of colic. (2) *Lumbo-abdominal neuralgia*, which is indi- s limitation to the branches of the lumbo-abdominal nerves, presence of characteristic points of tenderness. (3) *Cuta- uscular pain* of a nervous character, which is distinguished d disappearance on the application of Faradic electricity. *scribed peritonitis*, in which fever and dulness on percussion ent symptoms.

nosis is almost always favorable, though somewhat dependent abits of the patient.

ent. Speedy relief from pain may be obtained by the hypo- ction of morphine and atropine, or by the internal adminis- wenty to thirty grains of chloral hydrate or opium in half- every hour until pupillary contraction is observed. The ıould be covered with a large warm poultice that has been ith a drachm of chloroform. Mild cases may be relieved by twenty drops of chlorodyne, or by teaspoonful doses of the d tincture of opium, given with a few drops of the tincture f peppermint, in a wineglass of hot water. Frequent recur- ıe paroxysms requires careful regulation of the diet, and hing, to avoid chill. Electricity is sometimes beneficial as a er-irritant and tonic.

PART IV.

DISEASES OF THE LIVER, PANCREAS, PERITONEUM, AND SPLEEN.

CHAPTER I.

DISEASES OF THE LIVER.

Constriction and Occlusion of the Biliary Passages—Icterus.

ETIOLOGY. The only symptom by which *constriction* of the *biliary ssages* can be recognized is the occurrence of *jaundice*. Since the essure within the biliary canals is very low, slight obstructions are fficient to produce stagnation of the bile and its resorption through e lymph ducts and capillary vessels into the general circulation of the dy. The seat of obstruction may be located either in the biliary pillaries themselves, or in the large bile ducts outside of the liver.

Jaundice may accompany any disease of the liver that is not attended destruction of the secretory cells of the organ, yet it may be sometnes absent and sometimes present in the course of the same disease; circumstance which is dependent upon the condition of the biliary ssages. It may also result from *enlargement* of the *periportal lymph nds*, or as a consequence of *cancerous nodules* by which the hepatic ct or the common bile-duct are compressed. An *inflammatory conion* of *those ducts*, or the obstruction of their common orifice by *arrhal swelling* of the *duodenal mucous membrane*, may occasion gnation of bile and jaundice. In like manner the *intrusion* of *eign bodies*, such as gall-stones, or the seeds of fruit, or intestinal rasites, may produce obstruction. The same thing has been observed a consequence of *cicatricial constriction* and the development of *neoms* and *malignant growths* that encroach upon the biliary passages. *ronic peritonitis* may constrict the passages; and their *congenital clusion* by intra-uterine inflammation has also been known to occur.

Intra-thoracic diseases that interfere with the *movement* of the *phragm* may sometimes favor the stagnation of bile within the er, since its evacuation is greatly aided by the pressure to which the gan is subjected during the movements of respiration. In certain ses an *occlusion* of the *portal vein* may lead to jaundice, through a duction of pressure within the branches of the vein to a point below e tension of the bile in the biliary passages. Under such circum-

stances bile readily finds its way through the capillary walls into the vascular channels.

SYMPTOMS. The *skin* acquires a yellow color, which also appears upon the mucous surfaces of the body, when they are subjected to pressure between the fingers, and upon the conjunctivæ of the eyes. This discoloration is first manifested about three days after occlusion of the biliary passages. It may be comparatively slight, or it may exhibit a brilliant citron or orange-yellow color; the *perspiration* contains bile pigment, and the *urine* becomes very deeply saturated, presenting the appearance of beer or porter. After exposure to the air, it frequently acquires a greenish tinge. Its froth is also yellow, and traces of albumin are sometimes visible. With a microscope, hyaline casts, which are sometimes covered with minute oil globules and epithelial cells, are almost always discovered.

The presence of *bile pigment* in the urine may be readily demonstrated by adding a few drops of tincture of iodine to a quantity of urine in a test-tube; on shaking the liquid the existence of pigment is indicated by the appearance of a chrome-green tint. The presence of *biliary acids* may be ascertained by dipping a strip of blotting-paper into urine in which a little cane-sugar has been dissolved; having dried the paper, the contact of a glass rod that has been dipped in concentrated sulphuric acid is followed, after a few minutes, by the appearance of a carmine or violet color that is rendered evident by transmitted light. In the absence of biliary acids the paper simply presents a brown discoloration.

In the absence of bile the *feces* assume a clay-colored appearance. The *bowels* are usually confined, and the discharges emit an offensive odor. They frequently contain an unusual amount of fat, in consequence of deficient pancreatic digestion.

The prominent part assumed by the liver in the metabolic processes of the body necessarily implies great disturbance in those functions as a consequence of biliary obstruction. The *digestive organs* speedily suffer; appetite disappears, or is replaced by an absolute loathing of food, though sometimes an abnormal hunger is experienced. The tongue is generally brown or yellow; the breath becomes offensive; there is complaint of a bitter taste in the mouth; nausea, eructation, and thirst are frequent occurrences. The abdomen feels as if distended, and a sense of weight and oppression is experienced in the region of the *liver*. The organ is enlarged and somewhat sensitive on pressure. When the common bile-duct is occluded, the *gall bladder* becomes greatly distended, but can be perceived as a smooth and rounded tumor, projecting below the liver near the right border of the right rectus muscle. A similar distention of the gall bladder follows obstruction of the cystic duct; under which circumstances the contents of the gall bladder become transformed into a thin, transparent, and colorless liquid. The *spleen* is frequently tumefied, especially in young children. Fever is absent, unless excited by intercurrent causes.

The duration of jaundice from biliary obstruction is exceedingly variable. If it be prolonged beyond six or eight weeks, it is probably dependent upon more serious diseases than simple catarrh or biliary

. Recovery is preceded by the gradual reappearance of a biliary
n the feces, and by its disappearance from the skin. The urine
lly loses its dark color, and finally the skin by degrees resumes
mal hue.

ing the course of jaundice the patient is often tormented by
in the skin; the irritation is frequently universal, though it
particularly annoying in the palms of the hands, the soles of
t, and between the fingers and toes. Its cause lies in a peculiar
ion of the cutaneous nerves by the acids and pigment of the

hematous and urticarious *eruptions* sometimes appear upon the
of the body. The perspiration, and among nursing women the
s charged with these substances; occasionally during pregnancy
us becomes jaundiced. Under such circumstances the death of
born infant is a common event, and the mother incurs the risk
e yellow atrophy of the liver.

ertain cases *xanthopsia*, or colored vision, occurs during the
of jaundice; this rare event is supposed to be dependent not
he discoloration of the optic media with biliary pigment, but
he condition of the central nervous organs, since the symptom is
ıtly intermittent, and does not coincide with the intensity of the
e.

movements of the *heart* are frequently retarded, even during
urse of fever from any cause. The patient becomes sleepless,
ted, debilitated, and despondent. *Death* may occur as a conse-
of progressive exhaustion, dropsy, hemorrhage, and diarrhœa.
tain cases the phenomena of *cholæmia* are developed; the patient
es delirious, restless, and unconscious; respiration is irregular;
s hemorrhage occurs from the mucous membranes and beneath
in; involuntary evacuations occur, and death concludes the
This fatal result has been attributed by some to the action of
liary acids; by others it is referred to cholesterine poisoning.
tain cases death has been observed as a result of the rupture of
ll bladder or distended biliary passages, followed by peritonitis.
re within the liver produces the phenomena of *hepatic abscess*.

THOLOGICAL ANATOMY. The most conspicuous appearance after
is derived from the general *pigmentation* of the *tissues*. The
passages and the *gall bladder* are usually dilated and distended
iquid; their walls are sometimes thickened, or they may be ex-
inarily thinned. The *liver* is enlarged, or, if the disease has
ued for a considerable period of time, it is contracted and firm.
ly cases its color is yellow, but at a later period it exhibits a
or dark color. The central veins in the lobules are surrounded
one of deeper color. The *kidneys* present a greenish hue, and,
tion, recent cases appear of a saffron-yellow color. The con-
e of the organ is flaccid and soft. The epithelial cells in the
rous ducts are stained with pigment, and the passages them-
are frequently obstructed with pigment and cylindrical casts

GNOSIS. *Jaundice* can be easily recognized by daylight, though
artificial illumination. It may be distinguished from the hue of

anæmia and from the cutaneous discoloration which accompanies *Addison's disease* or *cachectic conditions*, by the fact that in all such disorders the sclerotic coat of the eye remains white and unstained by the bile pigment that is so conspicuous in jaundice. The characteristic condition of the urine and of the feces also serves to complete the diagnosis.

PROGNOSIS. The prognosis is dependent upon the cause of the disease. It is favorable in catarrhal cases, but when appearances of dissolution of the blood or the symptoms of cholæmia are present, the prognosis is exceedingly unfavorable.

TREATMENT. A liquid diet, from which oils and fats have been as far as possible removed, must be recommended. An abundance of water, lemonade, or other agreeable drinks, may be allowed. The bitter taste and offensive condition of the mouth may be relieved by the mineral acids, which must be given in perfect dilution with a large quantity of water. Constipation may be relieved by the use of vegetable laxatives, such as rhubarb, the compound infusion of senna, compound licorice powder, and pills of aloes and rhubarb. Mercurials are unnecessary. The urine should be carefully collected and measured; if deficient in quantity, diuretics must be prescribed; of these the citrate of potassium is to be preferred (℞. Potass. citrat., ℥ij; aquæ, Oj. S.: A tablespoonful in a wineglassful of water, every two hours). Cutaneous irritation may be relieved by the use of bromide of potassium (half a drachm of the salt, every morning and evening). Warm baths in which a handful of soda has been dissolved are also a source of great comfort. Insomnia may be relieved by thirty-grain doses of chloral hydrate at bedtime or by the use of the same quantity of sulfonal. Cholæmia must be combated by stimulants and camphor internally or by hypodermic injections. Mustard poultices may be applied to the back of the neck; ice-bags to the head, and cups along the spine.

Catarrhal Jaundice—Cholangitis et Cholecystitis Catarrhalis.

ETIOLOGY. *Catarrhal jaundice* rarely occurs as a primary consequence of exposure to cold. It is generally produced by a *catarrhal inflammation of the stomach* and *duodenum* which has invaded the common bile-duct; though it may be excited by the presence of *parasites* or *calculi* or *foreign bodies* in the biliary passages. It is sometimes observed in connection with *diseases of the hepatic tissue* or as a consequence of *blood-stasis* dependent upon intra-thoracic disease. It is sometimes connected with *menstrual disturbances* which produce vicarious hyperæmia of the liver. It may result from *cerebral* and *nervous disturbances* which produce derangements in the hepatic circulation. In certain cases it is produced by the action of *lead* or *phosphorus*, or after the excessive use of *chloral hydrate*. In like manner it may result from the causes of *infective diseases*. The concomitant *action of cold*, *malaria*, and *impure water* is a frequent cause of the disease.

SYMPTOMS. The symptoms of *catarrhal jaundice* do not differ from those which have already been described in connection with *obstructive*

e. The duration of the disease varies from two to six weeks, it may occasionally continue for a longer period of time; but, cases, the suspicion of a more serious cause than catarrhal ation must be entertained. In cases that are characterized by inflammation the biliary passages may become permanently l, and *chronic jaundice* is the result.

OLOGICAL ANATOMY. An opportunity for observing the con- es of catarrhal jaundice is rarely furnished, since the disease y terminates in recovery. It is evident, however, that the bile- e obstructed by the swelling of their walls and by the accumu- exfoliated epithelium and mucus. The passages, above the constriction, become dilated; their cells are thickened; some- lcification takes place; and, if the cystic duct be obliterated, f the gall bladder is produced. The hepatic tissue is deeply ith bile pigment.

NOSIS AND PROGNOSIS. The recognition of catarrhal jaundice ally easy, though it may be confounded with *jaundice* from n of *gall-stones* in the biliary passages. Under such circum- however, colic is experienced, and the jaundice is of shorter than when it depends upon simple catarrhal causes.

rognosis is almost always favorable.

TMENT. The particular indication for treatment points to the of catarrhal inflammation. The patient should be restricted uid diet, and may be treated by the administration of dilute acids, either hydrochloric acid or nitro-muriatic acid, of which ps may be given in a large glass of water every three or four Lemonade may be allowed in unlimited quantities. Copious n of the colon with water, which should be retained as long as affords an excellent result. Sometimes, faradization of the region, or gentle compression of the gall bladder, causes the n of obstructions from the biliary passages, with consequent all symptoms. The same result sometimes follows the use of ely cathartic doses of podophyllin, which provoke an active is in the common bile-duct.

puration of the Gall Bladder—Empyema Cystidis Felleæ.

mucous membrane of the biliary passages of the gall bladder es undergoes suppurative inflammation. This frequently results e mechanical irritation that is produced by gall-stones, or para- other foreign bodies. The obliteration of the cystic duct which thus produced is followed by an accumulation of pus in the dder, which sometimes becomes greatly distended. The physi- s are those which might be expected from the presence of a or oval sac beneath the liver, near the outer border of the right muscle. Resorptive fever of a hectic character is frequently l. The prognosis is grave, and the treatment requires surgical tion.

Dropsy of the Gall Bladder—Hydrops Cystidis Felleæ.

ETIOLOGY. Dropsy of the gall bladder consists in the replacement of its normal contents by a mucous or serous liquid. It generally results from *occlusion* of the *neck* of the *gall bladder*, or of the cystic duct, by adhesions, or by the incarceration of gall-stones. The biliary contents of the gall bladder are then gradually removed by absorption, and the cavity is distended with a mucous or serous fluid that oozes from the walls of the cyst. In certain instances the gall bladder has been thus distended until its contents reached a weight of sixty or eighty pounds. The cystic wall becomes gradually atrophied, and the glandular structures of its mucous membrane disappear.

SYMPTOMS. The distended gall bladder may be recognized as a smooth and sometimes fluctuating tumor which moves with the liver, in unison with the respiratory action of the diaphragm. In the majority of cases no serious discomfort is experienced unless the tumor has reached an inconvenient size.

DIAGNOSIS. Cystic dropsy may sometimes reach such magnitude as to be mistaken for *ascites*. It may be distinguished from *empyema of the gall bladder* by the absence of fever and cachexia; from *cancer of the gall bladder* by its rounded and regular form, which differs from the firm and nodulated tumors of cancer; from *gall-stones* by a sensation of fluctuation or bladder-like tension instead of the stony hardness that is presented by an accumulation of calculi; from *excessive accumulations of bile* by the absence of jaundice, and by the greater duration of the disease; from *echinococci* by the absence of hydatid fremitus, and by the pedunculated character of the tumor; from *hepatic abscess* by the absence of fever and chills; from *hydronephrosis* by its movement in unison with the respiratory action of the diaphragm; from *ovarian tumors* by their similar independence of respiratory movement, and their development from below upward.

PROGNOSIS. The prognosis is generally favorable. Rupture rarely occurs unless from external violence.

TREATMENT. The treatment must necessarily be of a surgical character. The preference is usually given to cholecystectomy, since cholecystotomy is liable to be followed by a reproduction of the disease.

Cancer of the Biliary Passages.

Secondary cancerous growths sometimes invade the biliary passages from the neighboring organs, or occur by metastasis from distant structures. *Primary cancer* is a rare disease, and more frequently attacks the gall bladder than the biliary ducts. It produces a nodulated tumor which may attain to great size, and is accompanied by pain, jaundice, vomiting, bloody diarrhœa, and death by exhaustion. Sometimes the gall bladder is found distended with bile, or with gall-stones and broken-down cancerous masses, which may, by ulceration, effect a communication between the cavity and the peritoneal sac or the neighboring intestines.

)ther *non-malignant tumors* are occasionally described in connection h the biliary passages.

Biliary Calculi—Gall-stones—Cholelithiasis.

ETIOLOGY. *Biliary calculi* are most frequently observed among ien after the fortieth year of life. Many writers are of the opinion this greater proclivity on the part of the female sex is due to the nate connection between the circulation of blood in the generative ratus and in the liver. Sedentary habits, luxurious life, and nperance in eating and drinking are frequent causes of the disease. nany instances the presence of foreign bodies such as parasites, of blood, and calcified masses which have found their way into the ry passages, may serve as nuclei for the formation of calculous sits. They are not unfrequently discovered in connection with romatous changes in the arteries, and with cancerous disease of the and stomach.

ATHOLOGICAL ANATOMY. *Biliary calculi* may be developed or ied in any portion of the biliary passages. They are most fre- ntly found in the gall bladder. They vary in size from the most ute particles to masses that fill the entire cavity of the gall bladder, their number is proportionately variable, being sometimes counted he thousand. Their form varies according to the location of the uli; in the biliary passages they exist as cylindrical masses that are lded by the walls of the ducts in which they lie; within the gall der they present an irregularly oval outline, frequently resembling of a nutmeg; in other instances they possess a more or less poly- al shape, with opposing facets of an irregularly crystalline form; his way a cluster of gall-stones is sometimes formed that recalls the e of articulation among the small bones of the wrist. The surfaces he calculi are usually smooth and slippery, but sometimes they are ulated or mulberry-like. The color varies from light-gray to brown, -green, or black, according to the difference of chemical constitu- . Calculi that are composed of cholesterine are of a light color. more pigment they contain the darker the tint.

Moist gall-stones can be easily crushed, and they impart a greasy ation to the fingers. Sometimes they are composed of concentric rs; occasionally a foreign body can be found near the centre where as formed a nucleus for the deposit of calculous matter. The weight gall-stones depends upon their chemical constitution; cholesterine uli, however bulky, are of light weight, and when thoroughly dried float in water.

The chemical constitution of biliary calculi differs considerably; in majority of instances they are composed of pure cholesterine, and s a rare thing to find that substance entirely absent in any case. culi that are composed of simple pigment are colored either brown, green, or black. Calculi composed of calcium carbonate are occa- ally discovered; they may be recognized by their light color and r extreme hardness and weight. The most common variety of gall- e contains both cholesterine and pigment.

The presence of gall-stones very commonly serves to excite irritation and inflammation in the gall bladder and biliary passages; consequently, all the processes and products of inflammation may be there exhibited.

The proximate causes of calculous formation are not sufficiently known; it is probable that inflammatory conditions which occasion an excessive secretion of mucus may exert a modifying influence upon the structure of the biliary acids by which cholesterine and pigment are held in solution; catarrhal changes in the mucous membrane might then lead to a deposit of calculous matter. In the tissues cholesterine is held in solution by lecithine, while in the bile a similar condition of solubility is maintained by the biliary salts so long as the bile remains alkaline. When organic acids are redundant in fluids that contain cholesterine, calcic bases are dissolved out of the tissues, and are combined with the fatty acids and biliary acids of the bile, forming insoluble soaps and cholates. Cholesterine can no longer remain in solution, and is precipitated A similar result occurs in stagnant and concentrated bile, especially if the alkalinity of that fluid be reduced. Now all these morbid conditions are united when acid dyspepsia and a sedentary life concur to hinder the normal process of oxidation in the tissues. For this reason the arthritic diathesis is a potent predisposing cause of the disease.

Symptoms. The existence of biliary calculi remains often unsuspected throughout the whole course of life; in other cases the distended gall bladder and the nature of its contents can be readily distinguished beneath the margin of the liver; yet no inconvenience will be experienced unless liberation of a calculus takes place. In spite of various minor disturbances which cannot be positively referred to the biliary ducts and gall bladder, the existence of calculi cannot be positively affirmed unless the symptoms of biliary colic are experienced. Sometimes the paroxysm commences spontaneously, without any previous warning; in other instances it may have been preceded by violent exercise, or by agitation of a nervous character. The onset of the paroxysm generally follows some unusual indulgence in the pleasures of the table.

Biliary colic is characterized by intense *pain* of a boring, burning, or lancinating character, that is referred to the right hypochondriac region, but also radiates upward and downward along the entire right side of the body and into the limbs. The countenance expresses intense agony; the abdominal wall, especially upon the right side, is tense and rigid; pressure usually occasions an increase of pain; the paroxysm is almost always introduced by a *chill;* sometimes the *temperature* rises, but it frequently remains normal, or even subnormal. The *pulse* is subject to considerable variation, and *respiration* is intermittent and attended with difficulty; *vomiting* frequently occurs, and is sometimes associated with hiccough; the *bowels* are generally confined, though sometimes diarrhœa occurs; the *urine* is scanty, and loaded with urates; sometimes *delirium* and *hystero-epileptic* convulsions are exhibited by nervous patients; *convulsions* and *unconsciousness* may occur, even among previously healthy individuals.

The paroxysm usually continues for several hours; sometimes it ceases suddenly, but it often subsides gradually.

The occurrence of biliary colic is due to irritation of the biliary ducts a calculus which has become engaged in the passage. Obviously, larger and the rougher the stone, the greater the amount of suffer- which must continue until the passage has been cleared, either by escape of the stone, or by its relapse into the gall bladder. If the ulus becomes impacted in one of the ducts, acute pain may gradu- subside and give place to the symptoms of permanent obstruction. ie cystic duct be thus occluded, jaundice will not necessarily follow; when the hepatic duct, or the common bile-duct, is occupied by a ulus, jaundice generally appears in the course of three days. He- abscess or cancerous disease may sometimes occur as a sequel of mpaction.

fatal termination rarely follows biliary calculi. Recovery is the though relapses are very frequent. After a paroxysm, examina- of the stools during the period of a week will sometimes be rewarded ie discovery of calculi. The feces should be thoroughly mixed with r, and strained through a coarse sieve; but a failure to detect any- g is exceedingly common. When biliary calculi have become im- ed in the bile-ducts very serious consequences may be sometimes loped. The wall of the duct may become ulcerated and perforated, ing to the discharge of calculi into the peritoneum, and to the blishment of either encysted or general peritonitis. In other cases process of ulceration may be attended by adhesions, and by the ation of fistulous communications with the stomach, intestines, ary passages, or even with the intra-thoracic cavities and the air- ages. If such grave processes of ulceration and perforation do not place, the phenomena of obstruction may be exhibited in the terri- of the liver, which becomes enlarged, or, finally, contracted, lead- to death from cholæmia. Jaundice or dropsy of the gall-bladder be manifested as minor consequences of obstruction.

In certain cases the presence of gall-stones may occasion inflamma- and adhesion between the anterior surface of the gall bladder and abdominal wall, followed by perforation and the establishment of a ary fistula through which calculi and bile are discharged externally. foration is preceded by the symptoms of abscess at some point in abdominal wall. The process may occur in cases where, by reason ie absence of all symptoms, the previous existence of biliary calculi never been suspected.

he discharge of biliary calculi into the intestine is not always fol- d by relief from danger. Obstruction of the intestines by large stones, or by concretions for which they have furnished the nuclei, been known to occur. In certain cases typhlitis or its allied dis- s have been observed, in consequence of irritation of the cæcum and iiform appendix by calculi from the liver.

IAGNOSIS. The diseases with which biliary calculi may be con- ded are quite numerous. 1. *Gastralgia* generally follows a meal, companied by symptoms of gastric disorder, is located in the region ie stomach, and is not followed by jaundice. 2. *Colic.* Flatulence pain are generally diminished by pressure; and when caused by poisoning, other symptoms of that disease are exhibited. 3. *Hepatic*

neuralgia is usually associated with neuralgia in other parts of the body, and does not yield to the treatment of biliary calculi. 4. *Typhlitis, peri-* and *paratyphlitis* involve the right iliac fossa, where tumefaction may be discovered. 5. *Renal colic* is attended by pain along the course of the ureter, and frequently by the appearance of blood and sand in the urine. 6. *Wandering kidneys.* Displacement of the right kidney may be recognized by the presence below the liver of a movable tumor which corresponds in form with the kidney, and does not change its position in unison with the respiratory movements. 7. *Incarcerated internal hernia* occasions vomiting and other symptoms of intestinal obstruction. 8. The pain of a *psoas abscess* can hardly be mistaken for biliary colic, except in cases where gall-stones have become impacted in the sigmoid flexure. 9. *Aneurismal tumors* may be recognized by their peculiar pulsation. 10. *Intermittent fever* can only be mistaken for biliary calculi when daily paroxysms of neuralgia are dependent upon malarial infection. Their rapid relief by quinine stands in marked contrast with the failure of that drug to confer relief in the calculous disease. 11. *Cholera.* A paroxysm of colic might be mistaken for an attack of cholera when vomiting and purging are unusually severe, but the occurrence of rapid relief or subsequent jaundice may suffice to exclude that disease.

PROGNOSIS. So far as the paroxysm of biliary colic is concerned, the prognosis is very favorable, but relapses are frequent, and impaction may lead to very serious consequences.

TREATMENT. Pain during a paroxysm must be relieved by large doses of chloral hydrate (45 grains in sweetened water), or by the hypodermic injection of morphine and atropine near the gall bladder. The abdomen should then be covered with a large poultice that has been sprinkled with a drachm of chloroform. Liquid diet, with Vichy water or Seltzer water, may be allowed. After the subsidence of pain, the bowels may be kept in a soluble condition by the administration of rhubarb (infus. rad. rhei, a tablespoonful every three hours).

In order to hinder the production of gall-stones, the diet of the patient should be regulated by the exclusion of alcoholic drinks, and provision should be made for an abundance of exercise in the open air. The long-continued use of salicylic acid (10 grains three times a day) affords excellent results. Karlsbad water, Vichy water, and the Saratoga waters, are also of great service.

For the removal of calculi from the biliary passages, many remedies have been employed. Olive oil in large doses has been highly recommended, but the inspissated discharges which follow its administration are composed of mucus and pigment, and sometimes consist of lumps of soap. They rarely contain any genuine calculous constituent. Chloroform has also been administered in ten-drop doses five or six times a day, for the purpose of dissolving calculi, but without any positive result. Beneficial effects are frequently observed after the use of turpentine and ether (ol. terebinth. 1 : æther. sulph. 4; 20–30 drops four times a day), which, like salicylic acid, are known to increase the solubility of bile and to promote its easy discharge into the intestinal canal.

If frequently recurrent attacks of biliary colic admit of no permanent lief by medicine, surgical aid must be invoked. The operation of ecystectomy affords the most radical cure, though the establishment an artificial passage between the gall bladder and the intestine has en recommended.

CHAPTER II.

DISEASES OF THE HEPATIC PARENCHYMA.

Venous Congestion of the Liver—Hyperæmia Hepatis Venosa.

ETIOLOGY. *Passive congestion* of the *liver* may be produced by any use that hinders the onward passage of the blood from that organ to e heart. It is generally observed as a consequence of disease involv- g the intra-thoracic organs, or producing compression of the inferior na cava or of the hepatic veins below the diaphragm.

PATHOLOGICAL ANATOMY. *Passive hyperæmia* of the *liver* is indi- ted by an increase in its volume and in the amount of blood which it ntains. The peritoneal surface appears tense, smooth, and sometimes nsiderably thickened. On section of the organ, the central veins of e lobules appear distended, and are surrounded by a zone of darkly gmented cells which contrast strongly with the paler border of the inus. In chronic cases the liver undergoes irregular contraction, pro- icing an uneven and nodulated appearance of its external surface, hile its substance exhibits greater density than in the natural condi- n. This condition is produced by the proliferation and contraction the interlobular connective tissue. By the pressure thus exercised, d by the pressure of the dilated intra-lobular capillaries, the hepatic lls are compelled to undergo fatty degeneration and atrophy. This ndition may be distinguished from the appearances that are presented *cirrhosis* of the *liver*, by the fact that the hyperæmic liver exhibits a rker color, is less uniformly contracted, and is not accompanied by ronic enlargement of the spleen.

The whole territory of the portal circulation exhibits the phenomena blood stasis; the gastric and intestinal capillary vessels are distended; d the mucous surfaces of the alimentary canal exhibit the evidences catarrhal inflammation. Hæmorrhoidal dilatation of the rectal veins a common occurrence. The kidneys and other abdominal and pelvic gans show the signs of hyperæmia in consequence of their dependence on the condition of the inferior vena cava.

SYMPTOMS, DIAGNOSIS, AND PROGNOSIS. The most prominent mptom of passive hepatic congestion is furnished by the *enlargement* the *liver*. The right hypochondrium is evidently distended; the per border of hepatic dulness extends above its normal level at the erior margin of the sixth rib, while the inferior border of the organ

descends below the middle point between the ensiform process and the navel. These signs may be obscured by the presence of abdominal dropsy; after the removal of the fluid the limits of the liver can be readily determined. In recent cases rapid variation in the dimensions of the organ is often observed. *Jaundice* is frequently present. The concurrence of *heart disease* under such circumstances produces a very peculiar combination of cyanotic and icteric tints. The general symptoms of *gastro-intestinal catarrh* are usually present, and all the other symptoms of obstruction in the course of the circulation may be developed. The occurrence of *ascites* is especially connected with obstruction in the course of the portal circulation, and it is usually developed as a consequence of hepatic atrophy.

Subjective symptoms are generally limited to a sensation of pressure and tension in the hepatic region, which is increased by the erect position. It is frequently impossible to lie upon the left side, and pain is often experienced through the right shoulder and in the right arm. A certain amount of difficulty is sometimes experienced in *respiration* by reason of interference with the movements of the diaphragm. *Death* rarely occurs from the hepatic disorder, but is usually occasioned by the underlying causes of blood stasis.

TREATMENT. The diet must be wholesome and nutritious, including a very moderate allowance of fat, starch, and sugar. Half a dozen leeches may be applied to the anus, in order to unload the portal vessels, and the frequent application of cups or leeches over the region of the liver affords a certain amount of relief. Cardiac disease, upon which passive hyperæmia so often depends, requires the aid of digitalis or its substitutes. The vegetable laxatives should be employed for the purpose of relieving the bowels and aiding the hepatic circulation:

℞.—Infus. rad. rhei, a tablespoonful three or four times a day.
℞.—Infus. sennæ comp., a tablespoonful three or four times a day.
℞.—Pil. rhei comp., two or three pills at bedtime.

Vigorous patients may employ the strong cathartic mineral waters with advantage. Ascites frequently requires puncture of the peritoneal cavity. Diuretics are sometimes useful, but diaphoretics should be avoided on account of their debilitating effect upon the function of respiration.

Acute Congestion of the Liver—Hyperæmia Hepatis Acuta.

Acute hyperæmia of the *liver* consists in an increased afflux of blood to that organ. It generally accompanies an increase of activity in the portal circulation. This form of hyperæmia is a physiological process during the course of digestion. It may become a pathological event when repeated excesses at the table and deficient exercise exaggerate a normal function.

Hyperæmia frequently occurs as a consequence of *injuries* of the *liver*, and may lead to inflammation and abscess. It is not uncommon as a local concomitant of *local diseases* which develop within the substance of the liver, and it is often observed in connection with *infective*

eases, especially in *malarial fever*. Its concurrence with *menstrua-* a and as a consequence of menstrual suppression is not unusual, and nay result from the suppression of an habitual *hæmorrhoidal flux.* rtain well-known physiological experiments upon animals indicate a se connection between injuries or disturbances of the *nervous system* d the hepatic circulation, and may serve to explain the intimate ation between psychical and cerebral agitation and the states of the er.

SYMPTOMS, DIAGNOSIS, AND PROGNOSIS. The symptoms and diagsis vary in no essential particular from those which accompany ssive congestion of the liver. The prognosis is generally favorable.

TREATMENT. Hyperæmia that is produced by injuries may be reved by cold applications over the liver; by the application of leeches the anus; and by repeated cupping of the hepatic region; together th the use of vegetable laxatives. Malarial causes must be annulled the use of quinine and arsenic. Menstrual obstructions may be viated by the application of leeches to the inner sides of the thighs d by the use of hot foot-baths.

Perihepatitis.

Primary hepatitis is generally the result of injuries. The disease ay also occur as a *secondary consequence* of diseases involving the ver itself or the stomach, intestinal canal, and kidneys. It sometmes accompanies right-sided pleurisy, and in many instances it is a nsequence of syphilis.

PATHOLOGICAL ANATOMY. Perihepatitis may be either circumcribed or diffused, acute or chronic. *Acute hepatitis* presents the haracteristic appearances of acute peritonitis involving the serous inestment of the liver. Sometimes abscesses form beneath the peritoneal embrane or penetrate the connective tissue of the liver.

Chronic perihepatitis produces condensation of the hepatic peritoeum and frequently is accompanied by the formation of adhesions etween the liver and neighboring structures. Contraction of the inlamed capsule sometimes produces slight superficial depressions upon he external surface of the liver, and it may occasion a certain amount f constriction in the vessels at the hilum of the organ. The liver may lso become diminished in size for the same reason.

SYMPTOMS, DIAGNOSIS, AND PROGNOSIS. *Perihepatitis* is sometmes unsuspected during life. In acute cases the disease is ushered n by a chill and fever, accompanied by pain in the region of the liver hat is increased by pressure or any movement which involves the rgan. Slight jaundice may occur as a consequence of impediments n the way of the respiratory movement. Loss of appetite, vomiting, nd digestive disorders are frequent. *Chronic perihepatitis* is usually ccompanied by friction sounds which accompany the movements of espiration, and are produced between the upper hepatic surface and he inferior surface of the diaphragm; they are audible over the lower ibs upon the right side. Chronic jaundice and other symptoms of

interference with the portal circulation are frequently observed. The prognosis is generally favorable.

TREATMENT. Acute perihepatitis requires the application of warm poultices over the region of the liver, and the relief of pain by the hypodermic use of morphine and atropine. Cups, blisters, tincture of iodine, and mercurial ointment may be applied externally. Calomel may be given occasionally to aid the action of laxative remedies. The chronic form of the disease requires the treatment of such intercurrent disorders as may accompany its course. Long-continued external counter-irritation with blisters or cups is of considerable service.

Abscess of the Liver—Hepatitis Suppurativa.

ETIOLOGY. *Abscess of the liver* is more frequently observed in tropical climates, among the immigrants from the temperate zone, who do not conform to the customs and diet of the people with whom they are thrown, but who continue their alcoholic excesses under a southern sun. The disease occurs more often among men than among women. It is sometimes observed as a consequence of *injuries*, and in the majority of cases it is excited by the *migration of pyogenic bacteria* into the liver through the bloodvessels which communicate with that organ. In this way it may result from diseases or injuries of any of the abdominal or pelvic organs. It may occur as a consequence of *septic infection* through the *umbilicus* in newborn children. *Thoracic diseases* and *peripheral inflammations* may in like manner originate the disease, and it is a rather frequent consequence of *osseous inflammation*, especially when the spongy portion of the bones is involved in the inflammatory process.

Local diseases of the liver itself or of its *biliary passages* may serve as the starting-point from which hepatic abscess originates. In like manner *tumors* involving the neighboring organs may also extend to the liver and be accompanied by suppurative processes. But, in spite of the severest scrutiny, it is sometimes impossible to discover any apparent cause for the formation of abscess in the liver. It is possible that in some of these instances the disease may depend upon the migration of parasites out of the intestinal canal into the liver. This has been observed in the endemic diarrhœa or dysentery of the tropics that is excited by parasitic amœbæ.

PATHOLOGICAL ANATOMY. *Abscesses* of the *liver* may occur in any portion of the organ, but are much more frequently observed in the right lobe than in the left; they may be either single or multiple; their size varies from the most microscopical collection of pus corpuscles to a cavity as large as a cocoanut. The purulent contents generally consist of laudable pus; old abscesses frequently furnish a brown or chocolate-colored pus that is discolored by the admixture of bile or of blood from neighboring vessels which have opened into the cavity of the abscess. Microscopical examination of the pus indicates a great amount of fatty degeneration of pus corpuscles, with abundant débris, microörganisms, and cholesterine tablets.

The *liver* is usually much enlarged. The tissues around the abscess

e in a state of inflammation, by which a connective-tissue capsule is rmed around its cavity. The *biliary passages* are frequently dilated, pecially when the abscess compresses the common bile-duct, or the patic duct. The portal vein may also suffer similar compression, by ich *ascites* and *tumefaction* of the *spleen* are produced.

A superficial abscess, or a deep abscess that has worked its way near e surface, excites inflammation of that portion of the peritoneal membrane by which it is overlaid. In this way adhesions with neighboring gans are frequently produced, and the discharge of the abscess may directed into some one of the abdominal or thoracic cavities or organs. other cases the abscess may effect a communication with the abdominal wall, discharging itself externally at any point upon the surface of e body to which the pus has burrowed its way. Deep abscesses of e liver frequently fail to attain to an evacuation of their contents, hich, therefore, become caseated, encapsulated, and sometimes calcied. The resulting cicatrices, when a number of abscesses occupy the ver, lead to its irregular constriction in a manner somewhat similar to at which is produced by syphilitic disease of the organ. In rare inances the contents of the abscess become transformed into a thin, lloid substance which somewhat resembles the contents of an echinoccus cyst.

During the course of *pyæmia*, abscesses form in the liver, as well s in the lungs, in the brain, or in other organs of the body. The rocess is initiated by the entrance of microörganisms into the capillaies of the hepatic lobules, where they obstruct the circulation and oison the neighboring tissue cells with their excretions. The hepatic ells undergo a coagulative necrosis and disappear, while pus corpuscles re rapidly formed in their place.

SYMPTOMS. Small abscesses of the liver may frequently exist without exciting suspicion of their presence during life. In other cases the phenomena of an intermittent, hectic fever are developed. In still other cases the symptoms of typhoid fever exist. Sometimes the course of pulmonary consumption is closely counterfeited; and, again, the occurrence of hepatic suppuration must be inferred from a sudden appearance of pus in the urine or in the feces, or in the vomited or expectorated matters, or by reason of the development of empyema or pericarditis.

Typical cases of hepatic abscess are characterized by an enlargement of the liver, upon the surface of which a convex prominence, which cannot be referred to the gall bladder or to other causes, may be discovered. The region of the liver is prominent and painful on pressure, and every tumefaction which can be made out upon its contour moves in unison with the respiratory movements. In superficial abscesses a fluctuation can sometimes be clearly distinguished, and the friction sounds of perihepatitis become audible in its vicinity. The recti muscles, especially the right muscle, are sometimes tense and painful on pressure. Icterus may be observed, if the inflammatory process involves he biliary passages, or if they are compressed by the abscess. There s complaint of fulness and throbbing pain which frequently extends rom the hepatic region to the right shoulder and arm, or to the left

shoulder if the abscess be located in the left lobe of the liver. The general health and spirits are depressed; dyspnœa is sometimes experienced in consequence of the upward pressure that is exerted against the diaphragm and the lungs. Sometimes there is intense fever which assumes an intermittent or hectic character. Cough, vomiting, and eructation are frequent incidents. The bowels are either constipated or relaxed, and the urine frequently exhibits a reduction of its solid constituents.

Internal evacuation of the abscess is very liable to occur suddenly, and may be attended by alarming symptoms if accompanied by internal hemorrhage or interference with any of the vital functions. If several abscesses exist, their successive rupture may occasion a considerable variety of symptoms according to the locality and mode of evacuation.

The *duration* of the disease is exceedingly variable. In certain cases a fatal result may be reached in the course of a few days, while in others the disease lingers for months or for years.

DIAGNOSIS. Hepatic abscess is sometimes mistaken for *intermittent fever*. In such cases antiperiodic remedies produce no effect. From *pulmonary tuberculosis* the disease may be distinguished by the absence of tubercle bacilli and pulmonary débris from the sputa. An *echinococcus tumor* may be recognized by the hydatid thrill which it imparts on palpation. *Malignant tumors* must be differentiated by the history of the case, and by the presence of cachexia, or the evidence of malignant disease in other parts of the body. A *distended gall bladder* may be recognized by its uniform and cystic outline; in doubtful cases an exploratory puncture should not be neglected, since it is unattended with danger. *Abscesses and tumors which are unconnected with the liver* may be recognized by the absence of movements that synchronize with the movements of respiration. An *exudation in the right pleural cavity* may usually be distinguished from a large abscess in the upper convexity of the liver by its horizontal surface, and by the change of level which accompanies changes of bodily position. *Sudden evacuations* of *pus* into any of the internal cavities or passages must be differentiated from local diseases of the corresponding organs before they can be referred to an hepatic abscess.

PROGNOSIS AND TREATMENT. The prognosis is very unfavorable, especially in the absence of surgical treatment. Under such circumstances over 75 per cent. of the cases are fatal; though under the most favorable conditions for surgical interference the mortality is not less than 45 per cent. The best results are obtained when the abscess is evacuated through the air passages.

Cirrhosis of the Liver—Hepatitis Chronica Interstitialis.

ETIOLOGY. *Cirrhosis of the liver* is produced by a chronic, diffuse inflammation of the interstitial connective tissue of the entire organ. This differs from circumscribed interstitial inflammations by the fact that it is developed simultaneously throughout the whole extent of the liver; consequently every local and partial inflammation of the connective tissue which arises in the course of local diseases, like abscesses, cancers, tumors, and echinococci, must be excluded.

common *cause of cirrhosis* is found in the use of strong
uors; wine and beer rarely produce the disease. It is
served in connection with *metabolic disorders*, such as
etes. *Syphilis*, *malaria*, *tuberculosis*, and other *infective*
unfrequently excite cirrhosis of the liver. It is also
the action of *phosphorus* upon the organ.
ause of cirrhosis is found in the *invasion of the biliary*
inflammation; under such circumstances the disease is
by jaundice and enlargement of the liver. Among elderly
le proliferation of the connective tissue sometimes occurs
with *endarteritis* in other organs; this may be undoubt-
d at a comparatively early period, in certain instances, as
e of premature old age. Sometimes *chronic perihepatitis*
xtension of the inflammatory process, by which the con-
of the liver is invaded, and cirrhosis is produced.
cases, however, it is impossible to arrive at a positive
rding the nature of the cause or causes by which the
een excited.
f the liver occurs more frequently among men than among
is usually developed during the period of active life. It
ly encountered among young children who have been
ıdulge in alcohol, and they sometimes exhibit the disease
ence of syphilis, or tuberculosis, or other infective diseases.
ICAL ANATOMY. *Atrophic cirrhosis of the liver* com-
an enlargement of the organ which, finally, is succeeded
nd reduction in size, though it is not an uncommon inci-
both processes going on together in the same liver, and
orms of the disease may also be observed. The atrophic
y involves the left lobe of the liver; the organ may lose a
ıirds of its normal dimensions; its surface becomes uneven
d; the peritoneal investment becomes thickened and fre-
erent to the neighboring structures. The gall bladder
a small amount of bile. The *hepatic tissues* appear con-
their resistance to pressure and to incision is considerably
The organ presents a reddish-yellow color, from which the
disease was originally derived (κιρρὸς, yellow); this pecu-
lependent upon fatty degeneration of a portion of the liver
overloading of the remainder with pigment. The *con-*
e is visibly increased in amount, and forms irregular
which lobular groups are inclosed. Occasionally, a single
s encapsulated; but, under either condition, the result is
ompression and atrophy of the cells of the parenchyma.
f an incision presents a roughened and granular appear-
n of the protrusion of the hepatic elements which are thus
pressure, hence the term *granular liver* that is frequently
is form of the disease.
sels of the liver be injected, the branches of the portal
a great degree of impermeability, while the hepatic artery
tic duct readily allow the passage of the injection.
ical examination indicates extensive proliferation of em-

bryonic cells in the connective tissue, and inflammation of the minute branches of the portal vein; by the pressure thus exerted upon the hepatic cells, and by the consequent interference with their nutrition, as well as by the direct effects of alcohol and bacterial or other poisons, the secreting structures of the lobules are progressively destroyed. The liver cells exhibit fatty degeneration, displacement of their nuclei, and infiltration with bile. In this way the glandular structure of the lobule is, finally, broken down and replaced by a mass of pigment and detritus. By many excellent observers it is believed that the entire process is initiated in the cellular structure of the parenchyma which undergoes a process of degradation through the influence of alcohol or through poisons, while the changes in the connective tissue are of a secondary nature. In accordance with either hypothesis the final result is the same.

Jaundice rarely accompanies cirrhosis of the liver, because the biliary passages usually remain unobstructed. The portal circulation bears the brunt of the disease, and, consequently, the *peritoneal cavity* is often occupied by a *dropsical transudation;* the *spleen* is enlarged, and the *gastro-intestinal mucous membrane* exhibits catarrhal inflammation; the *kidneys* are not unfrequently involved in an inflammatory process that may be dependent upon the same causes which have excited cirrhosis of the liver; the intra-thoracic organs are, also, frequently invaded by diseases of a degenerative and dropsical character.

The so-called *biliary form of hepatic cirrhosis* is attended by great enlargement of the liver, which sometimes doubles its normal size; the entire organ is enlarged, and its structure is so condensed that it presents unusual resistance to pressure and to incision. The color of the organ is yellow or gray. The interlobular connective tissue is greatly increased, so that each lobule is encapsulated by the proliferating tissue. The interlobular bile-ducts are also involved in the inflammatory process and the biliary capillaries are increased in number throughout the peripheral portion of each lobule. Their epithelial lining exhibits great thickness, by which the flow of bile is considerably impeded. The newly formed connective tissue invades the territory of the lobules, and presses between the liver cells as far as the central vein itself. In this way the hepatic cells are compressed and atrophied. Unlike the interlobular inflammation by which atrophic cirrhosis is produced, *biliary hypertrophic cirrhosis* is characterized by the simultaneous occurrence of inter- and intra-lobular proliferation of connective tissue. In the last form of the disease the proliferating tissues do not undergo the contraction that is so conspicuous a feature in atrophic cirrhosis. For the same reason the hypertrophic form of cirrhosis is usually attended by jaundice, and runs its course without the development of ascites, since the portal circulation does not undergo the obstruction which arises in the course of atrophic cirrhosis. The *spleen* also becomes tumefied, probably through the influence of the same causes that produce hepatic enlargement. The liver does not undergo fatty degeneration, since the course of the circulation is not sufficiently obstructed to excite this process.

Syphilitic cirrhosis of the liver is characterized by a tendency to

contraction and lobulation of the liver. The cirrhotic process
the individual cells of the parenchyma, which become separately
ated by proliferation of the connective tissue. *Senile cirrhosis*
er is characterized by extensive endarteritis and obliteration of
ls. The interlobular veins are greatly dilated, and in other
the appearances of atrophic cirrhosis are present.
sis of the liver that is caused by *phosphorus poisoning* com-
n the cells of the parenchyma, and the interstitial inflammation
s a secondary consequence. In like manner *malarial cirrhosis*
by the poisonous action of malaria and bile pigments which
he cells of the parenchyma, and there originate the processes
sult in proliferation of the connective tissue. It is probable
forms of cirrhosis may be thus originated.
TOMS. *Atrophic cirrhosis* of the *liver* commences insidiously
symptoms of gastro-intestinal catarrh. Only when the liver
exhibit changes in its magnitude, or when dropsical accumula-
rs in the peritoneal cavity, can the disease be certainly recog-
At first, the liver appears to be enlarged, its lower border may
low the navel, but this is succeeded by notable contraction of
. In certain cases the nodular surface of the liver can be felt
he abdominal wall, and the friction sounds of perihepatitis can
ized. The occurrence of *ascites* is an important symptom,
only indicates an obstruction in the course of the portal cir-
Peritoneal effusion, and compression of the portal vein by
r its constriction by abdominal diseases, or by pylephlebitis,
excluded before the diagnosis of cirrhosis can be established
basis of a dropsical accumulation in the peritoneal cavity.
ly the dropsical liquid must be evacuated before the liver can
ted to an examination.
leen is usually very considerably enlarged as a consequence of
struction; though in certain cases its connective tissue under-
iferation under the influence of the same causes which have
e process in the liver. Previous inflammation of the splenic
ould, of course, prevent the tumefaction of the organ.
rogress of cirrhosis is accompanied by progressive emaciation,
earthy discoloration of the skin which indicates grave inter-
ith the nutrition of the blood. The distended abdomen con-
ngly with the thin and wasted limbs. Upon the surface of
the veins appear greatly dilated and tortuous, in consequence
pensatory circulation of the blood through abnormal channels,
o reach the heart without passing through the portal vein and
or vena cava. The inferior epigastric veins anastomose with
ior epigastric veins and the mammary veins, which, in their
passage to the blood by a retrograde course into the veins
er the superior vena cava. In like manner, a portion of the
od is forced through the umbilical vein, and reaches the
of the epigastric veins in the neighborhood of the umbilicus,
round the navel a circle of dilated vessels which has anciently
the name caput Medusæ, from a fancied resemblance to the
ks of that mythological personage.

In addition to the serious disturbances of digestion which occur, the *urine* is generally diminished in quantity, and deposits a copious sediment of urates. Albumin may be present, either as a consequence of nephritis or of the cachexia that is produced by blood stasis.

The *course of the disease* is very tedious, since it covers from three to five years.

As *complications of the disease* are sometimes observed hemorrhages either from the stomach or from the hæmorrhoidal veins, though hæmorrhoids are not commonly present. Blood is sometimes discharged from the bladder or from varicose veins in the œsophagus. The respiratory organs and the heart are sometimes greatly incommoded by the pressure from ascites. Peritoneal tuberculosis sometimes occurs, either alone or in association with pulmonary tuberculosis. Retinal hemorrhage and inflammation are sometimes developed, and xanthopsia has been noticed, probably as a consequence of jaundice. Fever is usually absent, though it may be developed in the course of the disease, and may assume an intermittent form.

Death frequently results from exhaustion. Sometimes it is preceded by the symptoms of dissolution of the blood, or by diarrhœa and intestinal hemorrhage, or by other intercurrent diseases. Occasionally, death results from cholæmia, which is probably caused by the inability of the liver to eliminate excrementitious matters and biliary constituents from the blood. The patients become restless and delirious, and sink into a typhoid condition, which may be accompanied by convulsions before the fatal termination.

Biliary or hypertrophic cirrhosis of the liver is indicated by great enlargement of the liver and spleen without the complication of ascites and enlargement of the external abdominal veins. Jaundice and diarrhœa are very common incidents. The disease usually lingers for six or seven years, and is often terminated by the occurrence of fever, delirium, and coma.

Syphilitic cirrhosis of the liver generally runs its course without any notable exhibition of ascites or jaundice or venous dilatation.

DIAGNOSIS. - In cases that are complicated by dropsy, the diagnosis is often impossible before the liquid has been evacuated. The diseases which may be confounded with cirrhosis of the liver are: (1) *Amyloid degeneration of the liver*, which is characterized by dropsy and enlargement of the liver and spleen, but is preceded by chronic suppuration or by the development of syphilitic or malarial cachexia. The urine is albuminous, jaundice is absent, and general dropsy is present. (2) *Cancer of the liver* is rarely associated with enlargement of the spleen; it usually occurs at an advanced period of life, and is accompanied by the development of cancerous disease in other organs or in the lymph glands. The evidences of cancerous cachexia are also present. (3) *Gummy tumor of the liver* may be recognized by the history of the patient, and by other evidences of syphilitic disease. (4) *Pylephlebitis* is characterized by the very rapid development of the symptoms of obstruction in the course of the portal circulation. (5) *Vascular engorgement of the liver* is usually characterized by the presence of the causes of hepatic hyperæmia. (6) *Chronic peritonitis* presents the

mena of pain, tenderness, and universal inflammation over the abdominal region.

GNOSIS. The prognosis is of the most unfavorable character, recovery does in rare instances occur.

ATMENT. The use of alcohol must be entirely abandoned, and et should consist chiefly of milk. If the liver be enlarged, laxa- ineral waters may be used with advantage. Leeches may be d to the anus, and cups over the region of the liver. Painful ions must be relieved by poultices. Malarial cases require the istration of anti-periodic remedies, with a change of locality to a y residence. Syphilitic cases should be treated with iodide of ium and mercurials. The hypertrophic form of cirrhosis is bene- y the administration of ammonium chloride, in three-grain doses three hours, or by the use of calomel and jalap, of each five grains day, for three days in each week during the space of one or two s. The operation of tapping for dropsy should be performed at a ratively early period, and should be repeated as often as may be ary for the relief of discomfort, since its frequent repetition is some- followed by the permanent disappearance of dropsical symptoms.

Yellow Atrophy of the Liver—Atrophia Hepatis Acuta Flava.

OLOGY. *Acute yellow atrophy* of the *liver* is characterized by a fatty degeneration and destruction of the hepatic cells, and by ion in the bulk of the organ. The disease is exceedingly rare, ay occur either as a primary affection, or as a secondary con- nce of previous diseases of the liver or of the entire body.

imary yellow atrophy of the *liver* is more common among women mong men. It is usually encountered during middle life, and is observed in connection with pregnancy, especially during the later n of that period. Its exciting causes are frequently associated motional agitation or with alcoholic excess. Phosphorus poisoning een assigned, in certain cases, as a cause of the disease, but the eration that is produced by phosphorus is certainly different from yellow atrophy of the liver.

e *secondary variety* of *yellow atrophy* of the *liver* is sometimes ed as a circumscribed and local affection associated with fatty and cirrhosis, or with certain infective diseases.

THOLOGICAL ANATOMY. *Acute yellow atrophy* produces great tion in the size of the liver; its substance becomes flaccid, and its various tints of a brilliant yellow color. The gall bladder is empty, or contains a small quantity of viscid, yellow bile. scopical investigation indicates fatty degeneration of the liver and complete destruction of their organization. Among the débris e observed crystals of bilirubin and tyrosin. Microörganisms are imes present, though no special variety has yet been discovered to nt for the disease.

e *blood* is thin, dark, and reduced in quantity. The *organs* are d with bile pigment, and in many instances *hemorrhages* are ed in different parts of the body. The *abdominal lymph glands*

are frequently tumefied and distended with blood. The *spleen* is enlarged and softened. The *gastro-intestinal mucous membrane* exhibits evidences of catarrhal inflammation. The epithelium of the *tubuli uriniferi* has undergone fatty degeneration, and the tubules sometimes contain leucin, tyrosin, and crystals of hæmatoidin. The muscular fibres of the *heart* exhibit fatty degeneration, and the *lungs* are sometimes inflamed. The *pleural cavities*, the *pericardium*, and the *meninges of the brain* are occupied by a serous exudation. The *striated muscles* have sometimes undergone fatty degeneration.

SYMPTOMS. The course of yellow atrophy is marked by *two stages*. *During the first*, the symptoms are introduced by the evidences of gastro-intestinal catarrh, which is followed by jaundice, beginning in the face and gradually extending over the body. This period may occupy several days or weeks.

The second stage of the disease is characterized by severe nervous symptoms. The patient becomes restless and delirious, screaming and endeavoring to get out of bed; spasmodic contractions of the muscles and paroxysms of trismus are developed; consciousness is progressively overwhelmed; coma is developed; the breathing becomes irregular and stertorous; and death occurs in a state of complete insensibility. During this time the *liver* rapidly diminishes in size; the process commences in the left lobe of the organ, and advances until the area of dulness is almost completely abolished. Pressure over the region of the liver excites evidences of pain. The *spleen* is usually enlarged, though such tumefaction may not be developed when copious hemorrhage from the intestinal canal reduces blood pressure, or if the spleen have been previously bound down by adhesions and inflammations of its capsule. Jaundice is almost always present, and a roseolous eruption, or petechiæ and subcutaneous extravasations of blood may be observed. The *urine* is diminished or even suppressed before death; its reaction is acid, and its color is like that of the urine in jaundice, though the pigmentary reaction of bile cannot always be discovered. The sediment contains a considerable quantity of leucin and tyrosine which possess great pathognomonic importance. (Fig. 90.) Hyaline casts are often remarked. Chemical examination indicates a reduction of urea, and its replacement by less highly oxidized compounds of nitrogen.

FIG. 90.



Crystals of tyrosine deposited spontaneously in the urine, from a case of acute yellow atrophy of the liver. (ROBERTS.)

The *tongue* is coated, and the lips and teeth are often covered with sordes. There is, frequently, vomiting of blood, or of coffee-ground pigments, from the stomach. The *bowels* are confined, the *stools* are scanty and destitute of bile. The later stages of the disease are often marked by *hemorrhage* from the

rnal and external surfaces of the body. The *pupils* are generally ted and sluggish. *Fever* may be absent during the whole course of disease, and the *temperature* sometimes falls below the normal level, ugh it may rise extraordinarily before death. The *pulse* exhibits all various indications of an enfeebled heart.

The *course* of the *disease* is rarely prolonged beyond a week.

Acute yellow atrophy is probably a local disease of the liver, though ether it be due to the action of microörganisms is not positively cided. The actual causes of the disease, at present, remain undis- vered.

DIAGNOSIS. Acute yellow atrophy of the liver may be differentiated m *jaundice* by rapid diminution in the bulk of the liver, and by the eedy termination of the disease in death. *Cirrhosis of the liver* may so be excluded by the rapid progress of atrophy. *Phosphorus poison-* g can only be differentiated by the history of the case, or by the dis- very of phosphorus in the ingesta..

PROGNOSIS AND TREATMENT. The prognosis is invariably bad, and e treatment can only be of a symptomatic character.

Fatty Liver—Hepar Adiposum.

ETIOLOGY. *Fatty infiltration* consists in an unusual deposit of fat the liver as a consequence of excessive feeding with fats and oils, ile *fatty degeneration* consists in the deposition within the liver cells fat that is derived from the decomposition of their albuminous con- ituents.

Fatty infiltration is usually observed in persons who consume large antities of sugar, starch, fat, and alcohol. It is a frequent accom- niment of obesity. *Fatty degeneration* follows those conditions in hich the liver cells receive an insufficient amount of oxygen through e blood; or it may accompany cachexia of every kind. The same rm of degeneration is sometimes observed as a consequence of high mperature in fevers, especially in the course of infective diseases. It ay also result from poisoning with phosphorus, arsenic, antimony, and hereal preparations which hinder the access of oxygen to the tissues. tty degeneration is also favored by obstacles in the course of the cir- lation; and it is frequently recognized in connection with local dis- ses of the liver.

PATHOLOGICAL ANATOMY. A moderate degree of fatty degeneration n be recognized only by the aid of the microscope; but, when the ocess has reached any considerable extent, the liver appears enlarged, d it may more than double its normal size. The organ is pale, like llow soap; its consistence is soft and flaccid, while yet warm from the ent subject. The *serous investment* is smooth, and stellate blood- ssels are visible beneath its surface. The *gall bladder* contains a all quantity of bile. On section the boundaries of the *lobules* appear defined; however, if blood stasis or biliary obstruction have preceded th, the central portion of the lobule may be colored a dark-red or ious hue. The *tissues* feel greasy, and impart a greasy stain to ulous paper. *Microscopical investigation* reveals a condition in

which the hepatic cells are filled with minute fat globules. In severe cases the liver cell may be occupied by a single globule of fat.

Chemical examination of the organ indicates that in *fatty infiltration* the liver cells contain oil that is stored up at the expense of the watery constituents of the tissue; while in *fatty degeneration* the fatty deposit takes place at the expense of the albuminous constituents, without expulsion of water.

Waxy liver is a term that has been applied to a variety of fatty liver in which the organ presents a waxy appearance, probably in consequence of a preponderance of palmitin and stearin.

SYMPTOMS. In moderate cases of fatty liver the disease may escape recognition during life; but, when the organ has become considerably enlarged, there is complaint of pressure and of pain in the hepatic region. As a consequence of progressive obstruction to the portal circulation and to the excretion of bile, there are symptoms of loss of appetite, nausea, vomiting, diarrhœa, gray-colored stools, and often hæmorrhoids; jaundice, ascites, and enlargement of the spleen do not occur, since the retrograde pressure of the blood is not sufficient to produce such incidents.

DIAGNOSIS. *Fatty liver* may be suspected among drunkards and gluttons, especially when there is enlargement of the organ without the ascites and tumefaction of the spleen which are frequently present in cirrhosis. *Amyloid liver* differs from fatty liver by the presence of general dropsy and albuminuria; and the lower border of the organ is more sharply defined, and more resistant than in fatty enlargement.

PROGNOSIS AND TREATMENT. The prognosis depends upon the causes of the disease, which by itself is seldom fatal. The treatment of fatty liver must depend upon its causes and upon the general condition of the patient.

Amyloid Liver—Hepar Amyloideum

ETIOLOGY. *Amyloid liver* is almost invariably a secondary disease that is developed as a consequence of cachectic conditions which arise in the course of chronic suppuration, ulceration, malarial poisoning, syphilis, exhausting discharges, and wasting diseases. It only occurs as a congenital disease in hereditary syphilis. It is more frequent among men than among women, and is generally encountered between the ages of ten and fifty years.

PATHOLOGICAL ANATOMY. The *size* of the liver may be very greatly increased; in certain instances it has been known to occupy the space between the third rib and the crest of the ilium on the right side of the body. Its *serous investment* is smooth, tense, and free from adhesions. The *substance* of the organ is firm and dense, almost as if it had been frozen. On incision the cut surface of the part appears like bacon, and thin sections are translucent. The *hepatic lobules* appear almost totally obliterated. If a section of the organ be treated with a solution of iodine (Iodin. 1, potass. iodid. 2, aquæ 100), and then washed in pure water, the amyloid portions appear of a mahogany brown color.

branches of the *portal vein* and of the *hepatic artery* offer no
le to injections, and the *gall bladder* is nearly empty.
en the process of amyloid degeneration is somewhat restricted, it
t conspicuous in the intermediate zone between the central and
ripheral portions of the hepatic lobules. Here the mahogany
which follows treatment with iodine contrasts strongly with the
ells of the peripheral portion and the bile-stained tissue that
nds the central vein of the lobule. Microscopical examination
tes the participation of the minute arterial structures of the liver
amyloid process, which, at a later period, may invade the capil-
essels, and may, occasionally, attack the veins; hence the early
rance of amyloid degeneration in the middle third of the lobule
the terminal twigs of the hepatic artery communicate with the
system. From this point the degenerative process extends to-
he central vein; and, last of all, occupies the peripheral portion
lobule, together with the interlobular branches of the portal vein.
ells of the parenchyma do not to any great extent participate in
ocess. It is not yet decided whether the invasive process is a true
eration that originates upon the spot, or whether it consists in the
ation of the tissues with matter from without. The amyloid pro-
ppears to be an albuminoid substance which yields leucin and
n like other albuminous substances.

MPTOMS AND DIAGNOSIS. *Amyloid degeneration* may often exist
considerable period of time without specific symptoms. In certain
it presents only the consequences of mechanical inconvenience
oned by the increasing volume of the liver and of the spleen; in
instances there is loss of appetite, vomiting, and diarrhœa, with
ence of bile from the stools; and if the kidneys participate in
sease, albumin may be discovered in the urine. Universal pallor
ropsy finally occur. Jaundice is not observed unless an accidental
ession of the common bile-duct has taken place. The duration
disease extends over many years. Death results from exhaus-
lropsy, or intercurrent diseases.

OGNOSIS AND TREATMENT. The prognosis is always unfavorable,
h recovery has been occasionally reported. The treatment must
d upon the nature of the diseases which have originated the degene-
process.

Cancer of the Liver—Carcinoma Hepatis.

OLOGY. *Cancer of the liver* is a comparatively common disease.
usually encountered in later life, after the fortieth year, and is
frequent among women than among men, by reason of its second-
nnection with cancerous diseases of the female generative appa-
It is less common in warm climates than in cold. It sometimes
s injuries, and it may be developed as a consequence of the impac-
f gall-stones in the biliary passages.

imary cancer of the liver is a rare disease; but *secondary cancer*
requent occurrence, especially when preceded by primary cancer-

ous disease in the territory occupied by the portal circulation and its collateral dependencies.

PATHOLOGICAL ANATOMY. *Cancer* of the *liver* may occur either in a circumscribed or in an infiltrated form. *Secondary cancer* almost always belongs to the circumscribed variety, and exists as a sharply defined tumor which contrasts strongly with the remaining portions of the organ. Cancerous tumors of the liver may be either single or multiple, and their size varies from that of a pin's head to the magnitude of a cocoanut, or even larger. In certain cases the liver has been found to occupy the entire space between the second rib and the crest of the ilium. On the contrary, small tumors may only come to light on incision of the organ. When they involve the superficial portion of the liver, the projecting mass is frequently characterized by a central depression that is caused by a greater contractility in those central portions of the tumor which receive less nourishment than the peripheral parts.

Primary cancers of the liver originate in the epithelial cells of the biliary passages, or in the hepatic cells of the lobules, which become transformed into cancerous tissue. *Secondary cancers* exhibit the same histological structure that characterizes the parent tumor. All forms of cancerous growths may be observed. Frequently, the biliary passages and the blood and the lymph vessels of the liver are invaded by the progressive growth; and in this way the disease may be transmitted through the ordinary channels of circulation into other organs.

Cancerous infiltration of the liver closely resembles the appearances observed in cirrhosis. Microscopical examination, however, indicates the nature of the disease.

The portal lymph glands usually participate in the degenerative process in connection with all forms of hepatic cancer; and, by their pressure, may interfere with the circulation of the blood or of the bile.

SYMPTOMS. *Cancer* of the *liver* may remain unrecognized either in consequence of its limited extent, or by reason of the severity of the symptoms which accompany the primary forms of disease by which it is conditioned. The principal symptoms depend upon mechanical and functional changes in the liver. The organ may be greatly enlarged, and the *tumor* may be distinguished from other tumors which are disconnected with the liver by its motion in harmony with the movements of respiration. When several tumors occupy the surface of the liver, their nodular prominences can be frequently distinguished through the abdominal wall; they are generally hard, and, sometimes, their umbilicated form can be recognized. There is almost always complaint of *pain*, which is either spontaneous or occasioned by pressure over the liver; this pain is sometimes lancinating, and frequently extends to the shoulder or into the pelvis. *Jaundice* is frequently observed; but only when the biliary passages are compressed by the tumor or by degenerated lymph glands. The discoloration of the skin speedily increases under such circumstances, and may reach a very high degree of dark pigmentation (melanismus). *Emaciation* progresses speedily; the extremities become *œdematous;* occasionally the jugular *lymph glands* become enlarged, though less frequently than when the stomach is the seat of cancerous

wth. The *inguinal glands*, in like manner, sometimes become en-ed. The *temperature* generally remains normal, or subnormal; asionally, the symptoms of *fever* are manifested; *consciousness* inarily remains perfect until the end of life, though sometimes the irium of inanition occurs during the last stage of the disease.

In many instances, *insomnia* and terrible *cutaneous itching*, without parent cause, are experienced; *appetite* and *digestion* fail; the *tongue* omes dry and brown; *vomiting* is not uncommon; the *bowels* are erally confined; and the *urine* is scanty and high-colored. Indican present in considerable quantity; and, sometimes, albumin may be covered. The *spleen* is sometimes enlarged; *peritoneal dropsy* is a mon incident, either in connection with general dropsy, or as a re- of local interference with the portal circulation. The *red blood-uscles* are reduced in number, and present a great variety of forms dimensions (poikilocytosis); the *white corpuscles* are sometimes in-ased in number, and the hæmoglobin is greatly reduced in amount.

The *course* of the *disease* is very rapid in young patients; the aver- duration of the disease is from a year and a half to two years and alf. *Death* may result from exhaustion; from internal hemorrhage; rom the consequences of the eruption of the tumor into the perito- l cavity or other cavities and passages of the body. It may also ult from a variety of intercurrent causes.

DIAGNOSIS. The diagnosis of hepatic cancer is sometimes attended h great difficulty. In certain cases, icterus is the only acute symp-, so that when chronic jaundice is associated with progressive emaci-on and failure of strength on the part of an elderly patient, hepatic ncer should be suspected. When a tumor can be recognized, it may differentiated from *tumors that are disconnected with the liver*, by participation in the respiratory movements; from *hepatic tumors* it y be differentiated by attention to their characteristic symptoms. A tended gall bladder is smooth, tense and pear-shaped. Abscesses of e liver, and large echinococcus cysts exhibit fluctuation. *Syphilitic mors* may be recognized by their history and association with other mptoms of syphilis. It is often very difficult, if not impossible, to tinguish between hepatic cancer and a similar disease in the stomach, ce all the ordinary evidences of gastric cancer may be produced by lignant disease in the liver alone.

PROGNOSIS AND TREATMENT. The prognosis is inevitably bad, and e treatment must be purely symptomatic.

Sarcoma and Adenoma of the Liver present no clinical symptoms by ich they can be positively differentiated from ordinary cancer of the gan. Other neoplasms which involve the liver may be studied in ecial works on Pathological Anatomy.

Women who have given birth to many children, and persons whose dominal tissues exhibit unusual laxity, sometimes present the symp-ns of **wandering liver**. The organ is displaced from its ordinary uation, and falls into the lower portion of the abdomen, where it ings upon its elongated attachments. Sometimes an intestinal fold

becomes interposed between the upper surface of the organ and the diaphragm, so that a distinctly tympanitic sound can be recognized in the hepatic fossa, while the lower portion of the abdomen is occupied by the liver, whose form can be distinguished through the abdominal wall when that is not overlaid with fat. The only treatment that is possible consists in mechanical support by properly fitting belts and bandages.

In rare instances a **transportation of the abdominal organs** has been observed, in which the liver and the spleen have exchanged places. **Hernial protrusion of the liver** through the diaphragm has also been observed.

Among women who wear tight corsets the liver is frequently deformed by the development of a furrow at the line where constriction is greatest (corset liver). The hepatic tissue becomes atrophied and thinner along the line of constriction. In certain cases the organ appears as if divided by this horizontal furrow, so that the lower segment resembles a tumor or mere appendage of the organ; and, occasionally, this mass has been removed by surgical operation.

CHAPTER III.

DISEASES OF THE HEPATIC BLOODVESSELS.

Portal Thrombosis—Pylethrombosis.

ETIOLOGY. Sufficient retardation of the arterial circulation in association with fatty degeneration of the vascular walls may give occasion for the formation of *thrombi* within the trunk, or in the branches of the portal vein. More frequently, however, the process results from compression of the vessel during the course of hepatic diseases. It is, therefore, not uncommon in *cirrhosis of the liver*, or in *obstruction of the biliary passages*, or as a consequence of *pressure exerted by tumors* which encroach upon the portal vein.

PATHOLOGICAL ANATOMY. On opening the portal vein its branches may be found occupied by a thrombus, which, according to its age, either resembles a fresh clot, or exhibits various degrees of decolorization. The vascular walls may be in a state of simple hypertrophy, or of fatty degeneration, or calcification.

SYMPTOMS. Extensive occlusion of the portal vein is attended with the symptoms of obstruction in the course of the portal circulation. The spleen becomes enlarged, the digestive organs present all the symptoms of passive congestion, and the peritoneal cavity becomes distended with fluid. The duration of the disease may cover many months or years, and death follows from exhaustion.

OSIS, PROGNOSIS, AND TREATMENT. It is scarcely possible to ate portal thrombus from cirrhosis of the liver; and chronic f the peritoneum frequently counterfeit its course. The prog- nfavorable; and the treatment is essentially the same that is for cases of cirrhosis.

uration of the Portal Vein—Pylephlebitis Suppurativa.

GY. *Suppuration of the portal vein* is almost always the consequence of inflammatory and ulcerative processes in ans which originate the portal system. It is, therefore, served as a sequel of intestinal inflammation or ulceration, be associated with hæmorrhoidal tumors, or with operations rectum.

OGICAL ANATOMY. *Suppurative inflammation* may be re- a limited portion of the hepatic branches of the portal vein, involve the whole trunk and periphery of the portal system. of the vessel are thickened, softened, sometimes ulcerated, nen contains various kinds of pus. The *liver* and the *spleen* ally enlarged, and small abscesses are not uncommonly ob- In certain cases the suppurative process invades the other of the body, and the phenomena of general pyæmia are dis-

MS. The symptoms are frequently those which characterize d suppurative processes. Fever of a hectic character, pain e over the region of the liver, and the evidences of metastatic n in other parts of the body, form the general features of . In many cases a typhoid condition is developed, and death d by the symptoms of delirium and coma. The duration of e seldom covers more than two weeks.

SIS. The disease may be easily mistaken for *abscess of the* in such cases there is no enlargement of the spleen, and diar- esent. *Biliary colic* rarely occasions symptoms of profound al disorder. The stools are clay-colored, while the urine ile pigment.

al jaundice is unattended by the chills and rapid failure of which mark the course of pylephlebitis. *Typhoid fever* is zed by the absence of jaundice, by the characteristic tempera- , by the presence of roseola, and by the appearance of typhoid the blood and stools. *Intermittent fever* rarely exhibits of jaundice, and yields readily to quinine.

SIS AND TREATMENT are exceedingly unsatisfactory.

patic veins are occasionally invaded by inflammation or by but they present no characteristic symptoms, and the morbid are merely developed in concurrence with other hepatic

CHAPTER IV.

DISEASES OF THE PANCREAS.

THE *pancreas* may be invaded by *inflammation*, or by *malignant disease*. *Hemorrhage* into its substance may occur in the course of other diseases that are accompanied by dissolution of the blood. The symptoms of these disorders are masked by the symptoms of the primary diseases with which they are connected.

Scirrhus and other cancerous diseases sometimes involve the pancreas, more frequently among men than among women, at an advanced period of life. The symptoms are very obscure, and often the existence of a pancreatic tumor can only be inferred from the progressive cachexia, or from the evidences of pressure upon the portal vein and common bile-duct that cannot be referred to causes involving other abdominal organs.

Cysts sometimes develop in the pancreatic glands, and may reach dimensions which necessitate their extirpation by surgical methods. Their nature may be inferred from their position behind the stomach, whence they protrude into the epigastrium, and by the fact that an exploratory puncture brings to light a bloody fluid which is rare in the ovarian cysts for which pancreatic cysts are sometimes mistaken.

The **mesenteric glands** are usually enlarged in connection with the majority of the diseases that affect the organs with which they communicate. They frequently undergo malignant degeneration, and become greatly enlarged, so that they may exert a very injurious pressure upon other abdominal organs and passages.

CHAPTER V.

DISEASES OF THE PERITONEUM.

Inflammation of the Peritoneum—Peritonitis.

ETIOLOGY. *Inflammation* of the *peritoneum* may be either diffuse or circumscribed, acute or chronic. A case which begins as a diffuse inflammation may terminate as a circumscribed affection of a limited portion of the peritoneal cavity; while an originally circumscribed inflammation may extend and involve the whole sac.

Peritonitis is directly caused by the action of microörganisms which excite inflammation, *e. g.*, staphylococcus pyogenes aureus, pneumococcus, etc. The influence of cold and of injuries is limited to the establishment of conditions under which microörganisms become active.

Rheumatism occasionally affords an opportunity for the develop-
t of peritonitis; attacking the joints, it may disappear from those
ities as inflammatory symptoms are manifested in the peritoneal
tory.

eritonitis is frequently caused by the *extension* of *diseases* which
uce or are accompanied by inflammation. In this way inflamma-
as and tumors of the abdominal organs may excite the disease. It
unfrequently results from *perforation* of the *peritoneal sac* by
rs or abscesses or cancerous growths which are developed outside
ie peritoneal cavity.

nfective diseases are frequently accompanied or followed by peri-
tis; and it sometimes develops as a result of other diseases, such
ancer and tuberculosis, which have invaded the peritoneum. In
e of all these well-known causes there are cases in which no appar-
reason can be discovered for the existence of peritonitis, though it
ot improbable that in such cases infective microörganisms have
d their way out of the alimentary canal or through the female gen-
ive organs into the peritoneal cavity.

eritonitis is most frequently observed during the first few years of
t life. It is more common among women than among men because
ieir predisposition to puerperal diseases and septic infection. New-
children not unfrequently suffer from peritonitis, which has been
ved from the mother through infection of the umbilical wound.

ATHOLOGICAL ANATOMY. As a consequence of the histological re-
blance between the peritoneum and the pleural membranes, identical
sequences follow inflammation in either locality. Peritonitis may,
efore, exist as an *adhesive inflammation* (Peritonitis fibrinosa), or
serous exudation (P. serosa), or as a *purulent effusion* (P. puru-
a), or the products of inflammation may become *putrescent* (P.
rida), or *mixed with blood* (P. hæmorrhagica).

At the commencement of an attack of peritonitis the sub-serous
odvessels become dilated and distended with blood, which reddens
surface of the membrane. The smooth, shining appearance of the
itoneum is exchanged for a dull and turbid layer. The endothelial
s become swelled, and are exfoliated. The membrane becomes over-
l with an exudation that consists chiefly of minute, fibrinous fila-
nts which enclose in their meshes numerous embryonic cells. The
osite surfaces of the peritoneal sac are thus bound together by ad-
ive bands which become thickened and, sometimes, partially organ-
d. If the disease terminates at this point recovery takes place, and
adhesions remain more or less permanent. In this way, circum-
ibed portions of the peritoneal sac may become divided from the
in portion of the cavity, and bands may be formed, which, in later
e, may become a source of danger through constriction or strangula-
n of the intestinal folds which they involve. Sometimes the process
ults in such an amount of contraction of the omentum and mesentery
t the mobility of the intestines is greatly impaired.

Sometimes a fibrinous exudation is followed by a *serous effusion*, by
ich the peritoneum is filled with a yellowish or slightly turbid liquid
t contains flakes of fibrin and endothelial cells. If the cellular con-

stituents of the effusion become numerous, a *purulent peritonitis* is the result; if, then, as a consequence of putrefaction, the purulent effusion undergoes decomposition, the *putrid form* of the disease is set up. Such decomposition may result from perforation of the alimentary canal and the passage of fecal matter into the peritoneal cavity. It sometimes happens, however, that a fecal odor is present although no communication can be discovered between the cavity and the intestinal canal.

Hemorrhagic peritonitis, like the serous form of the disease, usually runs a chronic course, and is associated either with cancer or tuberculosis, or with the specially hemorrhagic diseases. In certain rare instances, the bloody effusion undergoes a certain low grade of organization, like what is observed under similar instances in the meningeal cavity of the brain, or in the pleural cavities. (Hæmatoma peritonei.)

In many cases of *purulent peritonitis* the serous membrane becomes eroded and ulcerated; sometimes, in this way, perforation of the walls of the cavity may be produced, and the intestinal contents may thus escape into the ureters, or the bladder, or may find their way through the diaphragm into the thorax, or through the abdominal wall into the external world. If the abdominal vessels are thus penetrated, death follows, either as a consequence of hemorrhage or of pyæmia. In certain cases, a purulent peritonitis may become encapsulated by the formation of adhesions; the pus may finally undergo caseation or calcification. Under such circumstances tubercular infection is not an uncommon sequel.

Symptoms. *Acute, diffuse, purulent peritonitis* sometimes occurs suddenly; or it may be preceded by chills and fever, with the ordinary symptoms which accompany a febrile movement; pain is experienced in the umbilical region, or it may be diffused over the whole abdomen; the slightest pressure becomes intolerable, and the patient lies continually upon the back, with the knees bent, and the thighs drawn up to the belly, in order to relax the abdominal muscles as much as possible; every kind of movement which can involve the peritoneal surface is dreaded by the patient; the abdomen is distended by the formation of gas, which remains imprisoned in the bowels by reason of the paralytic condition of the intestinal muscles; the abdominal muscles are tense and rigid as a consequence of reflex excitation. Sometimes a distinct friction sound can be heard and felt over the abdominal wall. The presence of liquid effusion causes dulness and a sensation of fluctuation, if the patient can tolerate the examination that is necessary for its demonstration.

Peritonitis almost always commences with *vomiting*, by which the contents of the stomach are evacuated. The vomited matters then assume a grass-green color; sometimes fecal vomiting takes place. As the disease advances to a fatal termination, vomiting is replaced by *hiccough;* the *tongue* is usually coated, or red and dry; the *bowels* are sometimes loosened at the commencement of the disease, but generally they become closely confined; the *urine* is reduced in quantity, and sometimes contains a little albumin; indican is also present; urination is attended with pain and difficulty, especially when the serous investment of the bladder is inflamed. The *temperature* is considerably

rated, often reaching 105° F. The *course of fever* may be either tinued, remittent, or intermittent; the *pulse* is frequent, small, and k. The *countenance* indicates intense pain and exhaustion; the e is sometimes reduced to a whisper; *consciousness* is seldom dis-bed, though delirium and spasms sometimes appear before a fatal mination; *respiration* is hurried and shallow, in consequence of the ward pressure against the diaphragm; the absence of diaphragmatic piration constitutes an alarming symptom. As a consequence of dominal distention, the lungs and the heart are forced upward; the x of the heart sometimes beats in the third intercostal space.

Acute, purulent peritonitis generally terminates in *death*, though life y be prolonged for a number of days; the fatal termination is some-es very abrupt, as if by shock; in other cases it appears to result m asphyxia, by reason of the difficulties which obstruct respiration; other cases the patient passes into a state of collapse, or life termi-tes by septic poisoning.

In certain instances the disease passes into the *subacute* and *chronic rm*, which may continue for many weeks, and be accompanied by merous complications. Spontaneous evacuation of pus may occur in y direction, or the peritoneal contents may become encapsulated, and parent recovery may take place, though subsequent relapses are equent. Under the most favorable circumstances, the sequelæ of ritonitis are greatly to be feared.

Puerperal peritonitis usually commences about four or five days after hildbirth, with great distention of the abdomen, and the symptoms of iarrhœa or dysentery. There is less pain than in the ordinary form of eritonitis, and the course of the fever is frequently interrupted by evere chills. Purulent infection of the entire organism frequently fol-ows, and death usually occurs in the course of the second week of the lisease.

Acute, circumscribed peritonitis is that form of peritoneal inflamma-tion which is limited to the serous investment of the different abdominal rgans, hence the term perihepatitis, perinephritis, perityphlitis, peri-metritis, etc., which characterize the different forms of circumscribed peritonitis.

Perforative peritonitis may destroy life in a very short time; but, if the perforation be preceded by adhesive inflammation, the course of the lisease may be greatly prolonged, and may assume a very moderate legree of severity. When excited by a sudden perforation, like that which is produced by gastric or intestinal ulcer, the patient complains of a udden, frightful pain, as if something had given way within the body. The symptoms of collapse are rapidly developed; cold sweat covers the allid skin; the extremities become icy cold; the abdominal wall is tense, nd inordinately sensitive to the slightest touch; life ends in unspeak-ble torment in the course of a few hours.

Less violent forms of the disease correspond closely with ordinary urulent peritonitis; vomiting, pain, and the other symptoms of acute nflammation are manifested; gas from the intestinal canal frequently nters the peritoneal cavity, and the abdomen is distended by the asso-iation of gas and liquid in the peritoneal sac (Pneumo-peritonitis).

Under such circumstances, the intestines are pressed backward against the spinal column, and their movements are no longer apparent through the abdominal wall. Agitation of the body produces a succussion sound, like that which is heard under similar circumstances in the pleural cavity, and the limits between liquid and gas can be readily demonstrated by percussion.

Chronic peritonitis. Circumscribed forms of chronic peritonitis may be gradually developed without any characteristic symptoms, in connection with local diseases of the various abdominal organs. The diffuse form of chronic peritonitis sometimes exists as a result of the acute form of the disease, or it may occur as a complication of tuberculosis or cancerous invasion of the peritoneum. It is sometimes developed in connection with scurvy or chronic inflammation of the kidneys. In certain cases a chronic serous peritonitis exists that is with difficulty distinguished from ascites.

Chronic peritonitis is characterized by a very moderate degree of pain, but the peritoneal cavity exhibits evidences of considerable distention with fluid, which renders rapid movement difficult and distressing. Occasionally, patients are able, as in corresponding cases of chronic pleurisy, to continue the occupations of an active life in spite of their condition; but, under ordinary circumstances, the functions of digestion and nutrition are seriously impaired.

The *duration* of the disease is very uncertain. Tuberculosis and cancerous disease lead to a fatal result. *Death* frequently follows as a consequence of gradual wasting and exhaustion.

DIAGNOSIS. Acute peritonitis must be distinguished from (1) *gastralgia*, which is characterized by a painful condition of the stomach that is frequently diminished by pressure, or by taking food. (2) From *colic*, which is marked by wandering pain, flatulence, and borborygmi. (3) From *biliary* or *renal colic*, which are accompanied by disorders of the liver and kidneys, by pain in the hepatic or renal territories, and by the appearance of calculi in the stools or in the urine. (4) *Rheumatism of the abdominal muscles* is characterized by a superficial location of the pain in the muscular layer of the abdominal wall. The differential diagnosis between peritonitis and ascites will be considered in connection with that disease.

PROGNOSIS. Every case of peritonitis is serious. Even after apparent recovery, the possibility of future difficulty by reason of adhesions and intestinal incarceration or constriction must always be kept in mind.

TREATMENT. The diet must be restricted to liquids. The abdomen must be covered with a warm poultice, or, if that cannot be tolerated, a layer of flannel, wrung out of hot water, may be laid upon the abdominal surface and covered with oiled silk or thin rubber cloth. Half a grain of opium should be given every hour until the pupils become contracted; after that, the interval may be lengthened; but under all circumstances, and especially during the course of puerperal peritonitis, opium should be given in quantity sufficient to allay pain, and to reduce the pulse below one hundred beats. If vomiting prevent its exhibition by the mouth, hypodermic injections of morphine may be

ployed. A constipated condition of the bowels may be relieved by use of large injections of water. Severe pain at the outset of the ease may be reduced by the application of a number of leeches over seat of greatest suffering. Excessive meteorism can be abated metimes by the external and internal use of the oil of turpentine. ncture of the intestinal coils with a fine trocar has sometimes given ief, but this operation is not without the danger of exciting a putrid ritonitis by the admission of feces into the peritoneal cavity. metimes the introduction of a long rectal tube beyond the sigmoid xure affords opportunity for the escape of imprisoned gas. High ver requires the use of acetanilide and phenacetine in doses of five to teen grains as required.

For information regarding the treatment of purulent peritonitis by parotomy and washing out the peritoneal sac, the surgical text-books ay be consulted. Chronic peritonitis requires a nutritious diet, and neral treatment with iodide of potassium, iodide of iron, and external unter-irritation. If the effusion be of a serous character, it may be- me necessary to tap the peritoneal cavity.

Peritoneal Dropsy—Ascites.

Etiology. The term *ascites* signifies the accumulation of a liquid ansudate within the peritoneal cavity. It is often observed as a cal manifestation of general dropsy. As an independent transuda- on, it is sometimes difficult to distinguish from the serous effusion of hronic peritonitis; and, as a matter of fact, the limit between the two iseases is sometimes not very clearly defined.

When peritoneal dropsy occurs independently of general œdema, it s the result either of an *increased pressure* within the portal vessels, r of *diminished resistance* on the part of their vascular walls. An ncrease of pressure attends all diseases by which the circulation of blood through the heart or through the liver is hindered; hence it accompanies the majority of severe cardiac, pulmonary, and hepatic diseases.

The resistance of the vascular walls appears to be diminished by all excessive discharges which reduce the albuminous constituents of the blood—*e.g.*, chronic nephritis, chronic diarrhœa, protracted suppura- tions, hemorrhages, cancerous diseases, syphilis, etc.

Ascites may occur at any age, but it is most frequently observed during the first half of adult life, when its causes are most commonly encountered. It has been observed, even before birth, to such an extent that the act of parturition was greatly impeded by the abnormal size of the fœtal abdomen. In such cases, congenital malformations and maternal dropsy are often noted as concurrent events.

Pathological Anatomy. The peritoneal cavity contains a large quantity of amber-colored liquid, which may be stained with *bile pig- ment* in cases of jaundice, or with *blood* in hemorrhagic diseases or when the abdominal cavity has been invaded by cancer or tuberculosis. Occasionally, crystals of cholesterine and flakes of endothelium may be discovered by the aid of the microscope. The *reaction* of the fluid is

almost always alkaline, and its specific gravity varies between 1004 and 1014. Chemical analysis indicates the presence of the constituents of blood plasma, as might be expected from the source of the fluid. In certain cases of cancer, or tuberculosis, or chronic inflammation of the peritoneum, the liquid presents a *milky appearance*, which is caused by the presence of numerous cells that have undergone fatty degeneration and solution (Ascites adiposus). In rare cases, after rupture of the chyle ducts the ascitic fluid consists of *chyle* in a greater or less degree of purity (Ascites chylosus).

In *chronic cases of ascites* the abdominal organs may undergo a certain amount of atrophy from pressure, and the peritoneal membrane appears thickened and clouded as if its cellular structure had undergone maceration. Usually the transudate is freely movable within the peritoneal cavity; but, in rare cases, its movements are hindered by the existence of peritoneal adhesions.

SYMPTOMS. The amount of transudate within the peritoneal cavity must exceed thirty ounces before its presence can be readily detected. Any considerable accumulation is attended by a sensation of fulness

FIG. 91.



Ascites. (RUSH MEDICAL COLLEGE CLINIC.)

FIG. 92.



The shading indicates the position of the *percussion-dulness in a case of ascites*, while the patient is lying on the back, the fluid falling to the low level in the flanks, and the umbilical region remaining clear. (FENWICK LAYSON.)

and tension within the abdomen; as the cavity becomes distended, the movements of the diaphragm are impeded, and respiration becomes more shallow and difficult. The symptoms of subacute gastro-intestinal catarrh are usually present, and frequent micturition follows the increase of presssure upon the bladder. The lower portion of the abdomen becomes very prominent, and its upper portion follows suit as the liquid rises. (Fig. 91.) The cutaneous surface is pale, smooth, and shining. In severe cases, the abdominal wall is marked with purple

æ which indicate the lines of tension and partial rupture that involve subcutaneous tissue. After evacuation of the peritoneal cavity by operation of tapping, these striæ assume a cicatricial appearance, the lineæ albicantes which indicate a previous pregnancy. The cutaneous veins also present an appearance of distention, and their erficial anastomoses become very apparent, especially when the portal culation is obstructed. The navel frequently becomes very promit and distended with fluid.

Fluctuation within the abdominal cavity may be readily demonstrated placing the palm of one hand upon the lateral surface of the belly r the upper limit of the transuded fluid, and with the finger-tips of other hand tapping lightly upon the opposite side of the body. A tinct impulse can be thus distinguished through the medium of the erposed liquid. Percussion readily indicates the limits of the tranlation, though its upper surface does not present an absolute level, account of the ascent of the liquid between the folds of the superinnbent intestines. When the patient lies flat upon the back, the gion of dulness occupies the lateral and inferior portions of the abdon, while the umbilical region is tympanitic by reason of its occupan by the gaseous intestines. (Fig. 92.) If the intestinal canal be e from fecal contents, the region of the cæcum and of the descending on will emit a tympanitic sound on percussion, even though the jacent regions are occupied by the dropsical fluid. Obviously, the ea of dulness will vary with every change in position, unless the trandate is encapsulated by peritoneal adhesions.

The *duration* of the *disease* may cover many months or years. Reapses are not unfrequent. *Death* usually results from the underlying uses of dropsy; or it may be produced by asphyxia, in consequence compression of the thoracic organs.

Diagnosis. The diagnosis of ascites is established by two symptoms: uctuation within the abdomen, and the presence of dulness that is subct to variation through changes of position. If any doubt exists with egard to the character of the fluid, it can be readily removed by n exploratory puncture. If the specific gravity of the liquid thus btained does not exceed 1015, it is a dropsical transudation, and not a peritoneal exudation, by which the patient is distressed.

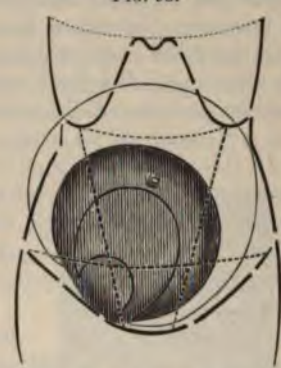
It may be, sometimes, difficult to differentiate ascites from an ovarian yst (Fig. 93), but the differential diagnosis will be assisted by attention to the following points:

Ascites.	Ovarian Cysts.
n the dorsal position the belly is flattened.	The abdomen remains prominent.
The navel assumes hernial prominence.	The navel remains unchanged, or it is depressed.
bdominal distention is uniform.	Distention is locally circumscribed.
n the dorsal position, dulness on percussion occupies the lateral portions of the abdomen.	Dulness occupies the anterior portion of the abdomen, while the lateral portions are tympanitic.
he upper limits of dulness present an undulating contour.	The upper limit is uniform.
ariations in position are accompanied by corresponding variations of the percussion note.	There is no corresponding change.

Ascites	Ovarian Cysts.
Fluctuation occupies the whole width of the abdomen.	Fluctuation is restricted by the limits of the tumor.
The uterus is often very movable, and the vaginal walls are depressed by the superincumbent fluid.	The uterus is generally elevated or pushed aside, and the vaginal walls are not depressed.
The specific gravity of the dropsical fluid is less than 1014, and the liquid is clear and transparent.	Specific gravity between 1018 and 1024, and the fluid exhibits a thick and turbid character.
Microscopical examination reveals the presence of endothelial cells.	Cylindrical cells are present.

PROGNOSIS AND TREATMENT. The *prognosis* in ascites depends upon its cause, and the *treatment* must be guided by similar considerations. Cathartics, diuretics, and diaphoretics must be chosen in accordance with the directions given in previous chapters. When the liquid transudate cannot be restrained within tolerable limits, it is advisable to puncture the abdominal wall, and to evacuate the fluid. This should not be looked upon as a last resort, since the comfort of the patient may be thus greatly increased, and the chances of ultimate recovery are correspondingly improved, for in many cases repeated puncture has finally led to permanent disappearance of the dropsy. The operation may be readily performed by the aid of a trocar which has been thoroughly cleansed in a five per cent. solution of carbolic acid. The patient may remain in a recumbent position, or, if possible, should sit upright in a convenient chair. The trocar should be quickly plunged through the abdominal wall, midway between the umbilicus and the pubes, having previously made sure that the bladder is empty. Many surgeons prefer a trocar that is provided with a stopcock, which can be connected with a rubber tube after the stylet has been withdrawn; through this the fluid flows readily into any convenient receptacle. Sometimes a fold of intestine may obstruct the entrance of the trocar, necessitating the introduction of a sound by which the intruding fold can be pushed aside. The evacuation of the abdomen may be assisted by passing two towels around the body, one above and the other below the trocar, while their ends are held by an assistant who stands behind the patient, and gradually draws them together as the abdominal swelling subsides. If faintness result from the development of cerebral anæmia through excessively rapid discharge of the fluid, the operation may be temporarily suspended; after the administration of stimulants, or after a short delay, the re-

FIG. 93.



Position of an *ovarian tumor* of the right side, in various stages of enlargement. The shading indicates the *percussion-dulness in ovarian dropsy of moderate extent:* the umbilical region is dull, from the presence of fluid, and the flanks remain clear. The outer circle shows a further extent to which the dulness may reach in ovarian dropsy. (BRIGHT.)

aining fluid may be evacuated. After the trocar has been withdrawn, e wound should be closed by the passage of a needle through its walls, d the application of a crucial ligature.

Good effects have sometimes been observed after faradization of the dominal walls with a strong current. Copious diuresis is thus produced, which sometimes relieves the dropsical swelling.

Peritoneal Cancer—Carcinoma Peritonei.

Peritoneal cancer is almost invariably a secondary development from malignant disease whose primary seat is in other organs of the body. The tumors sometimes attain great size, but in certain cases they appear in the form of minute nodules which resemble miliary tuberculosis. The disease is usually accompanied by peritonitis or ascites, and the exudation is, frequently, of a hemorrhagic character. The prognosis is unfavorable, and the treatment is purely symptomatic.

CHAPTER VI.

DISEASES OF THE SPLEEN.

Acute Enlargement of the Spleen.

Etiology. Rapid increase in the size of the spleen is frequently observed in connection with various diseases of which it forms one of the symptoms.

Traumatic enlargement of the spleen is not often observed. It is caused by injuries of the organ which produce dilatation of its blood-vessels, together with extravasation of blood, and increase in the size and number of the cells in the splenic pulp.

Acute embolic enlargement of the spleen is produced by embolic obstruction of its arteries. This accident usually follows the existence of vegetations upon the valves of the heart, which break loose and find their way into the general circulation.

The spleen sometimes becomes considerably enlarged by reason of *obstruction* in the course of the *circulation of the blood*, either as a consequence of disease in the heart, lungs, or liver. *Stagnation* of the blood in the *portal vein* is the most common cause of splenic enlargement. This may be produced either by cirrhosis of the liver, or by compression of the portal vein itself through the growth of tumors in its vicinity, or by inflammatory processes in the venous walls (pylephlebitis).

In the majority of cases of acute splenic enlargement the cause is connected with an *infective process*. It is therefore more or less conspicuous during the course of all infective diseases. The amount of enlargement is not dependent upon the severity of the disease, nor does

its maximum always coincide with the height of the fever. Sometimes the existence of splenic enlargement precedes the other symptoms of infection; and in other cases it persists for a considerable time after their subsidence. It has been remarked that after typhoid fever, relapses may be feared so long as the spleen remains enlarged.

It is probable that the swelling of the spleen which accompanies infective diseases is due to the local presence and activity of the micro-organisms which invade the system, either as primary infective agents, or as secondary followers of the original contagion. All minute particles of foreign matter that are introduced into the blood tend to find lodgment in the cells of the spleen, so that it is not difficult to comprehend the possibility of irritation and consequent proliferation of the splenic cells when they have been thus excited by an invasion of poisonous microphytes.

Pathological Anatomy. *Acute enlargement* of the *spleen* may attain to five or six times the normal size of the organ. When it is caused by *traumatism*, the evidence of injury may be discovered in the adjacent tissues and organs. When produced by *embolic obstruction* of the arterial branches, the characteristic pyramidal infarcts can be easily recognized in the substance of the spleen. Enlargement of the organ that is dependent upon *general obstruction* of the *blood circulation* is indicated by excessive distention of the bloodvessels, and by the existence of portal stagnation, or disease in the heart or respiratory organs. When enlargement is caused by an *infective process*, the organ is smooth and rounded; its capsule is transparent and tense. The splenic pulp is soft and friable, though tolerably firm. The splenic cells are enlarged, and their nuclei are multiplied and sometimes fatty. The vascular walls are infiltrated with round cells and blood corpuscles.

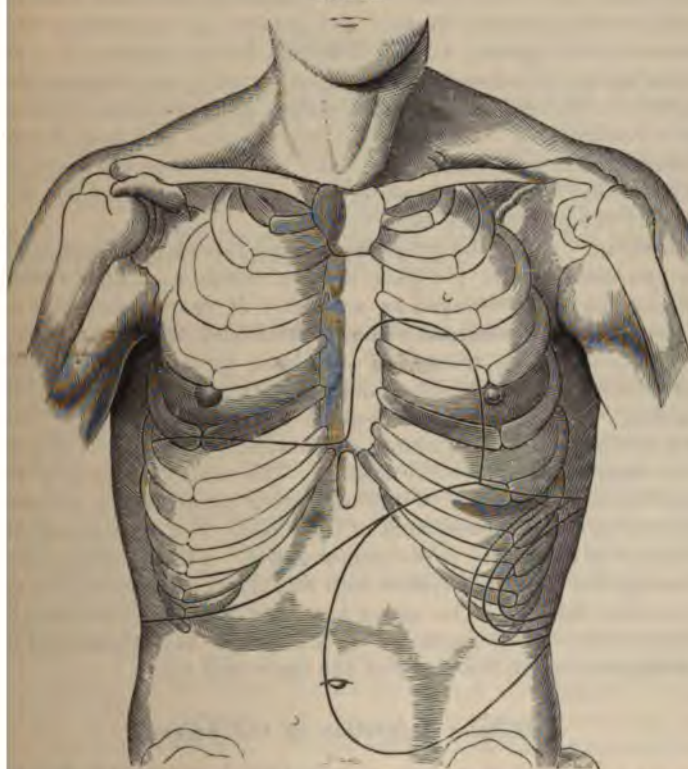
Symptoms and Diagnosis. *Enlargement* of the *spleen* may occur without any subjective sensations, but sometimes there is complaint of *tension* and *pain* in the splenic region, extending even to the left shoulder and into the lower extremity. This pain is sometimes increased when the patient lies upon one side or the other. Pressure produced by coughing or straining may also occasion suffering. If the abdominal wall is very thin, a large *tumor* may sometimes become perceptible as a projection from beneath the lower ribs on the left side. The tumor may under such circumstances be distinctly recognized by *palpation*, and it may be felt to change its position in unison with the respiratory movements. Sometimes the notch upon its anterior margin can be felt, when the organ protrudes considerably toward the median line of the body. When the spleen is considerably enlarged, the change of volume may be recognized by *percussion*, though it is necessary to avoid the sources of error which may arise from the presence of solid masses in the stomach or colon. Excessive distention of the bowels with gas may serve to obscure the evidence derived from percussion. Occasionally an audible murmur can be heard on *auscultation* over the spleen. This is caused by the movement of blood in the enlarged vessels of the tumor, and it somewhat resembles the placental murmur that is audible during pregnancy.

OGNOSIS AND TREATMENT. The prognosis depends upon the e of the cause of splenic enlargement. Rupture of the spleen s so seldom that it need not be taken into consideration. The se rarely requires any special treatment other than is indicated for ausal disease. Severe pain requires the use of morphine.

Chronic Enlargement of the Spleen.

TIOLOGY. *Chronic enlargement* of the *spleen* may result from its enlargement, but sometimes it is gradually developed as a chronic se. A very frequent cause is found in *malaria*, which need not sarily excite the symptoms of acute fever, but through the cachexia h chronic infection produces, the spleen is gradually enlarged.

FIG. 94.



ious degrees of enlargement of the spleen. The lines indicative of splenic enlarge- are copied exactly from Weil, but the percussion limits of the heart and liver have omewhat modified. (FINLAYSON.)

lenic tumor also accompanies leukæmia, pseudo-leukæmia, amy- degeneration, cancerous growths, tuberculosis, syphilis, rickets, scrofula. It is sometimes congenital, especially in syphilitic cases, gh otherwise rarely observed among children and old people.

PATHOLOGICAL ANATOMY. *Chronic enlargement* of the *spleen* may attain to twenty times its normal size, or even larger. In some cases it occupies the greater part of the abdomen. The *capsule* becomes thickened, and the anterior border of the organ exhibits one or more deep notches which correspond to the normal indentation of its margin. Sometimes *local peritonitis* and consequent adhesions exist. If *neoplasms* or *hydatid cysts* have developed in the spleen, they present themselves as rounded prominences. The existence of *embolism* is indicated by the presence of the characteristic *infarcts*. In certain cases the enlargement of the organ is chiefly caused by *excessive proliferation* of the *splenic cells;* but in that form of the tumor which is produced by blood stagnation the *connective tissue* chiefly is increased. *Malarial poisoning* causes a deposit of great quantities of *blood pigment* in the spleen.

SYMPTOMS AND DIAGNOSIS. The symptoms that have been already described in the previous chapter are present in connection with enlargement of the spleen; but, in addition, the symptoms of a *chronic cachexia* are also developed. The patient is pale, and the skin exhibits an earthy or chlorotic hue. *Palpitation* and *shortness of breath* are common occurrences. *Hemorrhage* into the skin and from the mucous membranes frequently takes place; and *anæmic murmurs* are audible over the heart and large vessels. In many cases *œdema* develops along with the progressive cachexia.

PROGNOSIS. Since the prognosis is conditioned by the cause of the tumor, an unfavorable prospect is very common. The *duration* of the disease may be prolonged for a number of years before the patient dies, worn out by the effects of compression and cachexia.

TREATMENT. The treatment of splenic tumor must be guided by causal indications. Syphilitic enlargements rapidly yield to iodide of potassium. Hydatid tumors require surgical treatment. Malarial spleens are benefited by quinine and arsenic, especially if the patient can be removed to a healthy locality. The various causes of anæmia require the administration of iron and other remedies that are useful in specific forms of impoverishment of the blood. The external application of cold and of electricity is sometimes useful. Various counter-irritants may be applied over the spleen with benefit in those cases that depend upon curable disease. The tumor has been removed with some degree of success when its enlargement and pressure have threatened serious interference with the functions of the heart and lungs.

Embolic Infarction of the Spleen.

In about one-half of the cases of *embolism* from valvular diseases of the heart the seat of obstruction is located in the spleen. The portion of the organ from which the blood-supply is cut off by occlusion of an arterial branch presents a pyramidal form, with its base at the periphery of the organ, and its apex at the point of obstruction near the hilum of the spleen. At first the infarct appears dark-red and hepatized, but gradually the color fades from the apex toward the base of the pyramid. The tissue cells within the obstructed territory undergo granular degen-

n and caseation, and finally constitute a relatively dry and crum-
mass. Sometimes calcification terminates the process, but in certain
the dead tissues are gradually absorbed, leaving only a pigmented
in their place. In this way the spleen may become considerably
med by cicatricial contraction. If the embolic fragment is charged
septic infection, an abscess may be produced in place of the ordi-
infarct.

e occurrence of splenic embolism may be suspected when valvular
se of the heart exists, and the patient suddenly complains of chills,
ting, and pain in the splenic region, followed by an enlargement
spleen itself. The only treatment that is possible is of an expec-
character. Pain must be relieved by hypodermic injections of mor-
; and the local application of cold or heat may be conducted in
dance with the feelings of the patient.

Perisplenitis.

erisplenitis has been already described under the head of local peri-
is. It is *caused* either by local injuries, or as a result of inflam-
on of the spleen itself in connection with various diseases and en-
ments to which the organ is liable. The principal *symptoms* are
accompanied by a certain amount of fever, and evidences of local
onitis. The *treatment* is the same as that which has been recom-
led for the control of circumscribed peritonitis.

Inflammation of the Spleen—Splenitis.

TIOLOGY. *Primary inflammation* of the *spleen* is rarely observed,
pt as a consequence of violent local injury of the organ. The
se usually occurs as a *secondary consequence of embolism*, especi-
after the intrusion of septic emboli into the branches of the splenic
y. For this reason abscesses sometimes follow the infective dis-
s. In certain cases splenitis is the result of inflammation propa-
d from neighboring organs. In this way ulceration and inflamma-
of the stomach, perinephritis, and gangrene of the lungs have been
wn to originate the disease.

ATHOLOGICAL ANATOMY. The size of a splenic abscess may vary
a that of a pea to that of a hen's egg. Sometimes, however, the
re substance of the organ breaks down, and the abscess is limited
by the splenic capsule. In this way abscesses containing many
rts of pus are developed. Under such circumstances the danger of
ture and of consequent peritonitis is very great.

YMPTOMS AND DIAGNOSIS. The symptoms of *splenic abscess* are
n very obscure, so that its recognition is sometimes impossible dur-
life. In other cases hectic fever and the usual symptoms of suppura-
may exist without any positive indication of their connection with
spleen. A positive diagnosis is only possible when a fluctuating
or can be discovered in the splenic region, or when a sudden
harge of pus into a neighboring cavity or passage is followed by the
sidence of such a tumor. Sometimes the pus burrows its way

through the external parts, and reaches the surface at a considerable distance from the site of the abscess. In all such cases a fatal result is frequently determined by peritonitis or by general pyæmia, consequently the *prognosis* is exceedingly alarming, and the *treatment* requires the efficient intervention of skilful surgery.

Amyloid Degeneration of the Spleen.

Etiology. The causes of *amyloid degeneration* of the *spleen* are the same that have been described as the causes of such degeneration in the liver, kidneys, and other organs of the body. The spleen appears to be more liable to amyloid degeneration than any other organ; and it is here that the process commences in the majority of cases.

Pathological Anatomy. The early stages of amyloid degeneration can be recognized only by the aid of the microscope, but when the disease is considerably advanced it may be easily recognized in two forms, the *sago spleen*, and *diffuse amyloid degeneration*.

The term *sago spleen* is applied to that form of degeneration which principally involves the Malpighian bodies. On section of the organ these appear in the form of pearly gray translucent masses, like grains of boiled sago. The characteristic reactions with iodine are very conspicuous.

Diffuse amyloid degeneration invades the whole organ, which is greatly enlarged and presents a firm and resistant mass, in color and consistence resembling smoked ham. It is by no means certain that this form represents an advanced stage of the disease, since the sago spleen is often observed in old cases of amyloid disease.

With the aid of the microscope, the amyloid process which commences in the capillary walls may be traced into the connective tissue. Opinions are divided with regard to the participation of the splenic cells in the disease.

Symptoms and Diagnosis. The early stage of the disease cannot be recognized, but when the conditions of amyloid degeneration are present, an enlargement of the spleen may be reasonably referred to that cause, especially when other organs of the body give evidence of degeneration.

Prognosis and Treatment. After the early stages of the disease have been traversed there is little hope of recovery. The *treatment* consists chiefly in the employment of preparations of iodine, and the iodide of iron. Mineral waters that contain these substances are considered beneficial.

Cancer of the Spleen—Carcinoma Lienis.

Cancer of the *spleen* rarely occurs as a primary disease. It usually follows the development of carcinoma in the liver, stomach, or abdominal lymph glands. It usually assumes the medullary form. Sometimes the new growth is deeply pigmented. Only when the spleen is greatly enlarged is the diagnosis possible, or when a splenic tumor is associated with evidence of cancerous growth in other organs. Sarcomatous

nors are not uncommon in the spleen; and occasionally other forms of nor have been discovered in the organ.

Rupture of the Spleen.

Rupture of the *spleen* is sometimes caused by direct violence, and asionally it results from enlargement that progresses too rapidly to restrained by the relatively unyielding capsule. Under such circumnces a sudden movement or compression of the tumor occasions its pture. This sometimes occurs as a consequence of the acute enlargent of the spleen that is connected with infective diseases. The ident is followed by the symptoms of internal hemorrhage, together h pain in the splenic region. *Death* usually follows in a short time, ugh occasionally recovery has been witnessed. If life be prolonged a few days the symptoms of peritonitis are added to those of hemorge, and the appearances after death correspond to the symptoms t were observed during life.

Wandering Spleen—Lien Mobile.

In certain cases the attachments of the spleen become relaxed to such legree that it descends by the force of gravity into the left iliac sa, or may be found upon the opposite side of the body when the ient lies upon the right side. It sometimes falls into the cavity of pelvis, or may be discovered in any part of the abdomen according the position temporarily assumed by the patient. Under such cirnstances it may be difficult to distinguish the splenic mass from a *ndering kidney*, from *enlarged lymphatic glands*, from *ovarian nors*, or even from *pregnancy* itself. A common cause of this conition exists in the enlargement of the spleen that has been previously scribed. Sometimes the splenic pedicle becomes twisted, and the scular supply of the organ may be thus cut off, so that the tumor generates and becomes atrophied.

In certain cases there is no complaint of subjective symptoms, but any patients complain of pain and dragging sensations, accompanied a disposition to defecation or micturition, caused by local pressure on the pelvic organs. Sometimes various perversions of sensation, d paresis in the lower extremities, may be referred to the effects of essure upon the large nerves in the lower part of the body. The *agnosis* is comparatively easy when the abdominal walls are thin, so at the outline of the spleen can be accurately defined. A recognition the characteristic notch in its anterior border greatly assists the agnosis.

A *congenital transposition* of the *liver* and of the *spleen* has been casionally observed. The spleen may also be very considerably disaced by various deformities and diseases that involve the thorax, and casion depression or elevation of the diaphragm.

The *treatment* of wandering spleen by medicinal agents is very unsatactory. Bandages and trusses are sometimes moderately successful, t in troublesome cases the extirpation of the organ may become cessary.

PART V.

DISEASES OF THE ORGANS OF RESPIRATION.

DISEASES OF THE RESPIRATORY APPARATUS.

CHAPTER I.

DISEASES OF THE NASAL PASSAGES.

Nasal Catarrh—Coryza—Rhinitis Catarrhalis.

IOLOGY. *Nasal catarrh* is a common consequence of exposure to and cold air. Unilateral chilling of the body is more dangerous equal refrigeration of all portions, hence the risk that is incurred posure to drafts of air when overheated. An exact discussion of anner in which inflammation is thus originated would occupy too space; it will be sufficient to direct attention to the part that is by the ordinary microbes of inflammation when the resistance of issues is diminished by cold. In like manner local causes may te to excite inflammation of the nasal membranes. Witness the s of wounds, injuries, inhalation of irritating gases, hot air, dust, the pollen of certain plants. Powdered ipecacuanha cannot be ed by certain persons without the production of an acute coryza. e of potassium, digitalis, and other substances occasionally produce me result. The arthritic constitution, the occurrence of menstrua- and mental excitement, sometimes act as predisposing causes of isease. Direct infection of the nasal mucous membrane with rhœal pus, and other infective discharges, is not unknown.

MPTOMS. Nasal catarrh may exist either as an acute disease, or hronic malady.

ute coryza. The attack is generally introduced with more or less ess, headache, feeling of weakness, pain in the back and limbs, oss of appetite, and other phenomena of a moderate fever. Nervous xcitable children may exhibit symptoms of delirium; and con- ns sometimes occur, perhaps as a consequence of the facility with chills, in such constitutions, are replaced by convulsions. In the of a few hours a sensation of dryness and of prickling is

experienced in the nasal passages. There is obstruction to easy respiration through the nose, and the voice acquires a nasal tone. The senses of smell and of taste are suppressed, and there is an inclination to sneezing.

These symptoms are soon followed by the appearance of a thin, watery liquid, with a saline taste, which distils from the mucous membrane of the nose; the saline character of the secretion is chiefly due to the presence of chloride of ammonium, which acts as an irritant to the cutaneous surface of the upper lip over which it flows. A few epithelial cells and pus corpuscles alone serve to cloud the transparency of the discharge, but in the course of a few days it becomes turbid with pus corpuscles, and assumes a greenish and albuminous appearance, constituting a muco-purulent discharge.

The inflammation may extend to the lining of the frontal sinuses; and, through the tear ducts, it may reach the conjunctivæ, producing all the local symptoms of conjunctivitis. In like manner it may invade the cavity of the antrum Highmori, producing sensations of fulness and pain, with a flow of liquid into the nasal passages when the head is laid upon one side or the other. The Eustachian tube may also furnish an avenue for the extension of inflammation into the cavity of the middle ear, with consequent pain, deafness, and abnormal sounds in the ear. When the posterior nares and pharynx are reached, sensations of heat and difficult deglutition are experienced. The disease may be propagated still further, invading the larynx and trachea, or the alimentary canal.

The duration of the symptoms is usually about a week, though sometimes it may become merged into the chronic form of nasal catarrh.

Nursing infants sometimes suffer from an acute inflammation of the nasal membranes. The congenital narrowness of those passages renders such an attack more dangerous than at a later period of time, because of the difficulty that attends the act of suction when the child cannot breathe through the nose. Artificial feeding may become necessary in severe cases.

Chronic nasal catarrh. Chronic nasal catarrh sometimes forms the sequel of an acute attack, or it may be the direct consequence of chronic infective disease, such as tuberculosis or syphilis. It sometimes forms one of the manifestations of a universal and chronic tendency to catarrhal inflammation, involving all the mucous membranes of the body.

The prominent symptoms are derived from obstruction of the nasal passages, rendering it necessary for the patient to breathe with the mouth partly open. Everyone is familiar with the peculiar expression acquired by such a condition of the respiratory passages. The senses of smell and taste are more or less impaired; the voice acquires a nasal tone, and there is a constant muco-purulent discharge, which sometimes is exceedingly copious, constituting what is termed *rhinorrhœa*. The mucous membranes of the nose are swelled, dark red, and covered with a muco-purulent secretion that forms obstructive crusts by which the nasal passages are filled. These sometimes undergo calcareous degeneration, and are transformed into the so-called *rhinoliths*.

n certain cases the inflamed surface is invaded by a specific bacillus illus fœtidus ozænæ), which by its activity causes the production of ntolerable odor in the nasal secretion. This variety of inflammation nown as *ozæna*.

he mucous membrane sometimes becomes ulcerated. The necrotic ess may extend to the cartilaginous and bony portions of the nose, ch, when invaded, give occasion for the formation of offensive dis-ges, constituting a special variety of ozæna, known as *ozæna rosa*.

hronic inflammation may affect the frontal sinuses and the antrum Highmore; the orifice of this last cavity is sometimes obstructed so the products of inflammation are retained and cause painful and terious pressure upon its walls.

he disease is more distressing than dangerous. If cured it is liable elapses, and it may excite reflex disturbances in other portions of respiratory tracts.

REATMENT. It is desirable, in all cases that are characterized by oclivity to catarrhal inflammation, that measures should be adopted improvement of the general health, and an increase of the resistance old. For this purpose, daily exercise in the open air, cold sponge hs, and active exercise, with sufficient clothing, and the avoidance of osure to the exciting causes of disease, must be advised. Special dispositions and chronic infective processes, such as are connected h tuberculosis and syphilis, require appropriate treatment.

Acute nasal catarrh seldom requires anything more than a hot foot-h, and a bowl of hot mint tea before going to bed. Ten grains of ver's powder administered at the same time will relieve pain and mote perspiration, thus frequently aborting the attack. A grain of nine three times a day may be taken, subsequently, for a week, with antage. If the local symptoms are attended with considerable irri-ion, inhalation of the vapor of warm water will give great relief. is may be easily accomplished by filling with warm water a narrow-ked jug or pitcher, which is held near the face, while a large towel hrown over the head, to retain the vapor. A one per cent. solution common salt, or of chloride of ammonium, may be inhaled from an linary spray-producing apparatus. Temporary relief may also be ained by inhaling air that is charged with the vapor of ammonia and bolic acid (liquor ammoniæ, acid. carbolici, āā 5 parts; alcohol, 15 ts; distilled water, 16 parts). A few drops of this, sprinkled upon k bibulous paper, may be inhaled every two hours. Care should taken to keep the eyelids closed during the operation.

The use of vaseline, or other lubricating substances, will diminish the dency to irritation of the upper lip and nasal orifices. Chronic al catarrh, in addition to the general measures that are requisite for improvement of the health, requires treatment with nasal douches medicated snuffs. A douche with a one per cent. solution of car c acid, or, as an astringent, a one per cent. dilution of liquor aluminii tici, may be employed three or four times a day. It should be fol-ed by a pinch of snuff composed of three parts of calomel and five ts of powdered alum. The nasal douche should be also employed,

instead of the ordinary irrigating apparatus, which is liable to produce injury of the auditory apparatus by forcing liquids through the Eustachian tube. A simple one per cent. solution of common salt, used with the nasal douche, forms the best means of removing crusts that are formed within the nose. For the cure of ozæna, two drachms of a one per cent. solution of permanganate of potassium may be added to a pint of tepid water, for use with the nasal douche. Other antiseptic solutions may be employed in the same way; iodide of potassium must be given in cases of a syphilitic character. Ulcerated surfaces may require the topical application of nitrate of silver. For fuller details, the student is referred to special treatises upon the subject.

Hay Fever—Catarrhus Æstivus.

ETIOLOGY. *Hay fever* occurs in two forms: as a *catarrhal inflammation* of the conjunctiva and respiratory passages; and as a special variety of *asthma*. It occurs more frequently among men than among women, and is most commonly experienced between the fifteenth and thirtieth years of life. It attacks persons of a highly organized and nervous constitution, and is almost unknown among the laboring classes.

The disease occurs during the summer, and disappears with the return of cold weather. It recurs every year, and, generally, reappears at a definite time for each patient. The commencement of the attack usually coincides with the blossoming of certain plants, the pollen of which is irritating to the mucous membranes of those who are the victims of this idiosyncrasy. The presence of pollen grains has often been demonstrated in the nasal secretion of hay fever, and their experimental introduction into the nasal passages has resulted in the artificial production of the disease.

SYMPTOMS. The symptoms of hay fever frequently follow immediately after exposure to the causes of the disease. A walk in the fields, or a change in the direction of the wind, bringing to the mucous membranes air that is charged with irritating particles, often excites an attack of sneezing, with uncomfortable sensations in the nose, followed by the appearance of abundant secretion, and swelling of the mucous membranes; the eyes become red and watery; the eyelids swell and become painful; similar conditions manifest themselves in the thorax, and may invade the larynx and trachea; slight febrile symptoms are sometimes present at the commencement of the disorder, and a feeling of discomfort persists throughout its entire course. Sometimes the nose becomes considerably swelled and reddened; erythematous eruptions occasionally appear upon the face, or upon other parts of the body. When the disease assumes an asthmatic character, the symptoms correspond with those of ordinary bronchial asthma.

Hay fever is never fatal, unless it may chance to occur in connection with other diseases which have completely undermined the vigor of the constitution.

TREATMENT. Of the greatest importance is the prophylactic treatment and the employment of measures for the improvement of the

ral health. Galvano-caustic treatment of the tumefied membranes, 's, and douches, have all been employed with comparatively little ess. Iron, quinine, arsenic, and strychnine are useful as general s and roborants; for the same purpose electricity and Turkish s have been employed with some degree of success. A solution of ine (1 part to 740) was highly recommended, for irrgiation of the l passages, by the celebrated scientist Helmholtz, who was himself tim of the disease. Recently it has been advised to make local ications of a ten per cent. solution of cocaine to the inflamed ous membranes; this gives temporary relief, but must be used with derable caution for fear of establishing the cocaine habit.

ne only certain method of relief lies in avoidance of the causes of fever. The patient must withdraw from such parts of the country e under cultivation, and must retire to the northern wilds of the te Mountains, or the Adirondack region, or the vicinity of the lakes Northern Michigan, Wisconsin, and Minnesota. There he must in until the first frosts of autumn destroy the polleniferous plants fill the air with irritating particles. In this way only can com- be secured during the summer months by those who possess the rtunate predisposition to hay fever.

CHAPTER II.

DISEASES OF THE LARYNX.

Catarrhal Inflammation of the Larynx—Laryngitis Catarrhalis.

ETIOLOGY. *Laryngeal catarrh* is observed more frequently among than among women, between the twentieth and fortieth years of It prevails in cold, damp climates, and is common during the ng and fall of the year, when the weather is most variable. Deli- ly constituted individuals, especially if they perspire easily and are lisposed to rheumatic affections, are very liable to catarrhal inflam- ons which sometimes affect one and sometimes another portion of mucous surfaces of the body. The causes of such local predispo- ns are unknown. In certain cases, however, the susceptibility of laryngeal mucous membrane is evidently dependent upon the occu- n of the individual. Witness the frequency of laryngitis among who inhale irritating vapors and gases, or are exposed to an sphere filled with dust.

Misuse of the *vocal organs*, such as is involved in public speaking, ng, shouting, etc., not unfrequently excites an attack of laryn- The *infective diseases*, especially those that invade the mucous branes, and certain chronic disorders of the *kidneys* and *liver*, her with *impoverishment* of the *blood* from any cause, operate as sposing causes of laryngitis. It may also accompany *disturbances*

of the *circulation* in the course of cardiac diseases, and it accompanies the development of *tumors* and *ulcerative processes* in the neighborhood of the larynx.

SYMPTOMS. The disease may occur either as an acute or as a chronic catarrh of the larynx. The *acute form* usually commences with a moderate degree of fever, like that which ushers in an ordinary coryza. The local symptoms, however, are experienced within the throat, and consist of a sensation of irritation and inclination to cough. There is a feeling of tenderness in the region of the larynx, with pain upon swallowing; sometimes external pressure over the larynx is painful.

The *cough* is at first dry and harsh; presently it is accompanied by the expectoration of a thin, transparent, slimy liquid that contains a few epithelial cells; gradually it becomes charged with round cells and pus corpuscles, and assumes a muco-purulent character; sometimes the sputa exhibit streaks of blood which indicate a considerable degree of severity in the inflammatory process.

The *voice* becomes hoarse, weak, and inclined to break. In severe cases it is reduced to a mere whisper as a consequence of local swelling that interferes with the movements of the vocal cords. Laryngoscopic examination discovers a brightly reddened and tumefied condition of the mucous membrane lining the larynx. The minute blood-vessels are dilated, and the surface of the membrane is covered with the products of exudation, which accumulate until they are removed by the act of coughing. Sometimes minute hemorrhagic points are visible.

In many cases the *muscles* of the *larynx* become temporarily paretic, or completely paralyzed, as a consequence of inflammation of their substance. The respiration is impeded, under such circumstances, so that death may occur, with symptoms of asphyxia.

Among young children of a nervous temperament and delicate organization, acute laryngitis not unfrequently occurs with the sudden development of symptoms indicating *laryngeal obstruction*. The disease commences abruptly in the night, after several hours of quiet sleep, when the patient suddenly awakes and starts up in an agony of suffocation interrupted by paroxysms of a hoarse, barking cough; febrile symptoms are often quite prominent, the face is flushed, the eyes are suffused, respiration is hurried and stridulous, with great difficulty in the act of inspiration, and retraction of the lateral walls of the thorax. The attack may continue for many minutes, or for a few hours, when it terminates spontaneously, unless arrested by the action of an emetic, or other anti-spasmodic remedy. Such cases, in their superficial features, bear a close resemblance to croup, or laryngeal diphtheria, hence the name *false croup*, by which they are frequently known. With the approach of morning, the urgent character of the symptoms disappears; and during the day, the patient may exhibit only the ordinary phenomena of subacute laryngeal catarrh; but the spasmodic paroxysm is liable to be renewed, though with diminished severity, for a number of successive nights.

The causes of false croup, or *laryngismus stridulus*, are not always identical. In some cases they appear to be dependent upon an excessive accumulation of mucus in the swollen air passages; in other cases

e symptoms are the result of an excessive irritability of the nervous stem, by which are produced spasmodic movements of the larynx, ich, in association with inflammatory swelling, render the act of res- ration difficult.

Chronic catarrh of the larynx. Chronic catarrh of the larynx fre- ently results from repeated attacks of acute laryngitis; or it may cur as a complication of other diseases; or as a result of long-con- nued misuse of the voice. The symptoms resemble those of acute ryngeal catarrh, only they are characterized by a minor degree of verity. The quality of the expectoration always resembles that which yielded during the advanced stage of acute laryngitis. Laryngo- opic examination discovers redness of the mucous membrane, though ss vivid than that which is apparent during the acute form of the dis- se; the bloodvessels are more prominent and tortuous than in health; ere is considerable swelling of the tissues, so that the vocal cords ppear thickened, and the epiglottis may be quite deformed; sometimes e mucous membrane presents a roughened, or villous, or granular ppearance. In severe or chronic cases, the mucous membrane may xhibit erosions and ulcerations, especially upon the free border of the ue vocal cords which are subjected to friction against one another in he act of phonation. Ulcerative processes are most frequently observed n cases that are dependent upon tuberculosis or upon syphilis or other nfective diseases. Sometimes *tumors* of a polypoid or papillomatous haracter occur as a result of the chronic inflammation. The mucous nembrane upon the inferior surfaces of the vocal cords sometimes be- comes greatly tumefied, and encroaches upon the glottis and upon the avity of the larynx, to a degree that is productive of great danger from uffocation.

Pathological Anatomy. The changes that are produced by chronic aryngeal catarrh are best observed with a laryngoscope during the life f the patient. Their general character has been already indicated. Microscopical examination reveals nothing more than the ordinary nultiplication of connective tissue and epithelial cells, with the products f the inflammatory process.

Diagnosis. No difficulty attends the diagnosis when it is based upon aryngoscopic examination. Without such investigation it is impossible o infer the nature or extent of the morbid processes that are concealed om view. (Fig. 95.)

Prognosis. The prognosis in catarrhal inflammation of the larynx epends upon the causes of the disease. In simple, acute cases, it is vorable. Chronic cases are liable to become very tedious, and relapses e frequent. Syphilitic and tubercular cases are sometimes attended th great danger.

Treatment. The necessary constitutional treatment has been already dicated, in connection with coryza and chronic catarrh of the nasal ssages. The treatment of acute laryngeal catarrh is identical with at already recommended in cases of coryza. Cough may be relieved Dover's powder, in one-grain doses every two hours, or by the use morphine—the thirtieth of a grain of morphine, with a drop of dilute drocyanic acid, may be given every two hours for the same purpose.

Various medicated troches containing small doses of opiates, and chloride of ammonium, are frequently employed with great benefit. Inhalations of the vapor of warm water, medicated with one to five per cent. additions of common salt, or the bicarbonate of sodium, or chloride of

FIG. 95.

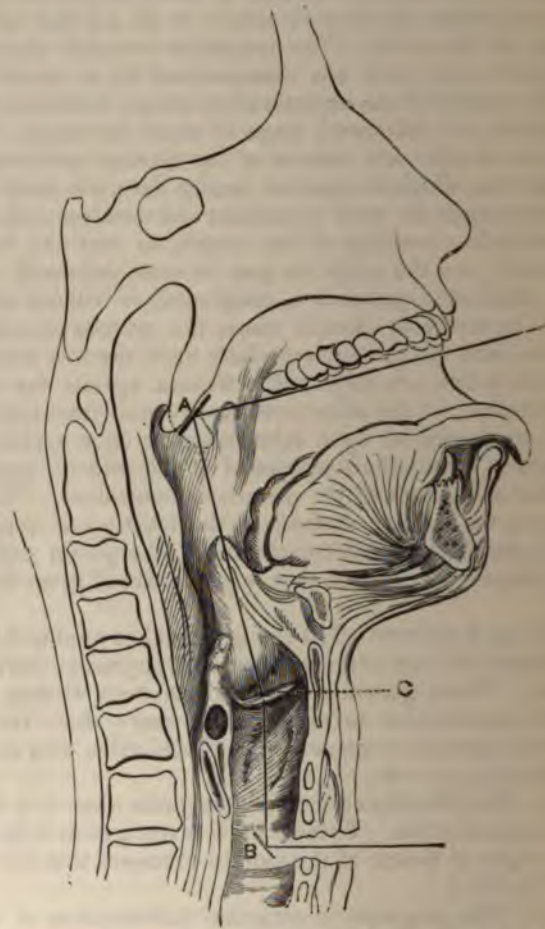


Diagram showing laryngeal mirror in position, and the angles of incidence and reflexion. A. Laryngeal mirror, pushing back uvula, but not touching wall of pharynx. C. Left vocal cord. B. Mirror introduced through wound in trachea after tracheotomy—infra-glottic laryngoscopy. (MORELL MACKENZIE.)

ammonium, are useful. It is advisable to commence with weak solutions, and gradually to increase their strength. They may be repeated as often as may be found agreeable to the patient, but the remedy must be changed every three or four days, on account of the tolerance that is established by the constant use of the same substance. The most convenient form of apparatus for the administration of inhalations is the ordinary Siegle's

ay-producer. In acute cases this may be kept in constant operation
ar the patient. In milder attacks it is sufficient to employ the inha-
ion every two or three hours.

When expectoration is copious and unattended by any difficulty, the
alation of astringent sprays should be recommended, *e. g.*, nitrate of
er (one-tenth of one per cent.), tannic acid or alum (one to three per
t.), sulphate of zinc (one-tenth to one-half of one per cent.), liquor
ri perchloridi (one-tenth of one per cent).

Laryngismus stridulus can be promptly relieved by placing the
tient's feet in a hot mustard bath, with a mustard poultice over the
per part of the thorax, and ipecacuanha in quantity sufficient to pro-
ce vomiting. Cases in which spasm is the prominent feature fre-
ently yield very quickly to the inhalation of ether; but this must be
ployed with caution in the vicinity of lights or fire, on account of its
flammable character. Perspiration should be encouraged with copious
aughts of hot herb tea. If death from asphyxia cannot be otherwise
erted, intubation of the larynx, or tracheotomy, may become neces-
ry. During the daytime, after a paroxysm of laryngismus, the patient
ould be thoroughly treated with expectorant doses of ipecacuanha, by
hich means a recurrence of the paroxysm may be averted. The treat-
ent of *chronic laryngeal catarrh* consists largely in the local use of
tringent powders, *e. g.*, tannic acid, acetate of lead, or alum, which
ust be introduced into the larynx by insufflation with an appropriate
strument; a small quantity of powder, not more than a grain, or a
ain and a half at a time, should be introduced into the tube, and
hile the tongue is drawn forward, it may be blown directly into the
rynx. The operation is at first very disagreeable to the patient, but
s daily repetition renders it more tolerable.

The general medication of chronic laryngeal catarrh should be guided
great measure by the history of the patient. Syphilitic cases require
ecific treatment; tubercular patients must be treated with reference
that special form of infection; rheumatic or gouty subjects require
remedies that are appropriate to their predisposition; for such cases
long-continued use of mineral waters that contain sulphur, or the
ly administration of sulphur in small doses.

℞.—Lac. sulphur. gr. v.
Potass. bitart. gr. j.
Sacchar. gr. x.—M.

S.—Once or twice every day will be advantageous.

For additional particulars the student is referred to the larger man-
s and special monographs.

Œdema of the Glottis—Œdema Glottidis.

Œdema of the *glottis* is the name that is applied to such constrictions
the glottis as are produced by liquid accumulations in the sub-mucous
nective tissue, whether they be of a serous or of a purulent character.
is process usually occurs in the loose tissues upon the posterior sur-
e of the epiglottis and in the aryepiglottic folds. It may extend

downward into the larynx itself. The swelling is usually bilateral; but it may be sometimes limited to one side, when it is dependent upon unilateral compression of the veins. The mucous surface appears pale when the affection is caused by simple obstruction; preceding conditions of inflammation occasion the display of a brighter color. On incision into the tissues a transparent serous fluid escapes; or they may present a gelatinous appearance with very little discharge; or they may be infiltrated with pus.

ETIOLOGY. Œdema of the glottis usually follows as a complication of *laryngeal disease;* it may also result from *wounds* or *injuries* of the larynx, or as a consequence of the passage of *acids* or *caustic alkalies* within the glottis, or as the result of *inhalation* of *scalding* and *irritating vapors*; it may occur as a consequence of the *extension* of *inflammation* from neighboring localities; and it is witnessed, sometimes, as a sequel of *infective diseases*, or of *Bright's disease*, and of *chronic diseases* of the *heart* and *lungs*. *Compression* of the *laryngeal veins* by *tumors* in the vicinity of the larynx, or within the thorax, may produce a genuine, non-inflammatory œdema of the glottis. In certain cases, however, it is impossible to assign any particular cause for the origin of the difficulty. The disease occurs more frequently among men than among women, between the eighteenth and fiftieth years of life.

SYMPTOMS. Œdema of the glottis sometimes arises suddenly, and terminates life with astonishing rapidity. In other cases, however, its origin is gradual, and the symptoms which precede its evolution succeed one another with varying severity for a considerable time before the final explosion. These cases are less dependent upon inflammation than the first class of cases.

The prominent symptom of œdema of the glottis consists in *obstruction* and *difficulty* in the act of *inspiration*. The voice becomes hoarse and disappears; there may be a barking cough; inspiration is stridulous and laborious; cyanosis appears, and the phenomena of asphyxia are followed by death, unless assistance can be promptly afforded.

If the tongue be grasped with a napkin and drawn forward, it may be possible with the laryngoscopic mirror to look upon the picture of the œdematous glottis and its tumefied periphery. The epiglottis is often converted into a thickened tumor by which the orifice of the glottis is more or less completely concealed. In other cases the œdematous tissues project over or between the vocal cords, producing more or less complete obstruction of the passage.

There may be considerable complaint of *local pain* in the throat, which is increased by the act of swallowing, or by pressure upon the œdematous parts.

DIAGNOSIS. The use of the laryngoscope greatly facilitates diagnosis, though the introduction of the mirror may be attended with considerable difficulty if the symptoms of asphyxia are urgent.

PROGNOSIS. The prognosis is very grave, since not far from seventy-five per cent. of reported cases have reached a fatal termination.

TREATMENT. In cases that are dependent upon acute inflammation, the suction of ice sometimes gives relief. External counter-irritation with leeches, or with mustard, or with blisters, is useful when the

mptoms are not sufficiently urgent to require more radical inter-
ence.

Cases in which the symptoms are principally dependent upon œdema-
s and dropsical conditions, may be sometimes relieved by the opera-
n of hydragogue cathartics, *e. g.*, compound infusion of senna with
phate of magnesia, compound cathartic pills, or croton oil.

But if œdema be rapidly developed, with increasing symptoms of
phyxia, it becomes necessary to resort to surgical interference, which
y be accomplished by scarification of the œdematous tissues with a
perly guarded bistoury. A blunt-pointed bistoury, wrapped with
cking-plaster to within a quarter of an inch of its point, may be
ided, by the aid of the laryngoscopic mirror, into the opening of the
ttis, where active incisions will usually give prompt relief. Should
s method fail, it will be necessary to attempt intubation or trache-
my. Operative interference must not be delayed too long; a fatal
sult has often occurred during the absence of the physician in search
his instruments.

richondrial Inflammation of the Larynx—Perichondritis Laryngea.

Etiology. Inflammation of the laryngeal perichondrium seldom
curs as a primary disease; it usually follows inflammations and ulcera-
ns of the larynx, notably after infective diseases.

Pathological Anatomy. The disease is most commonly witnessed
connection with the arytenoid cartilages; and, in successive order of
equency, it may affect the cricoid, the thyroid, and the epiglottic car-
lages.

The inflammation usually extends from the surface to the perichon-
rium, where it excites a suppurative process with consequent separation
the perichondrium from its cartilage. The formation of such
bscesses is itself attended with danger from the constriction of the
lottis that is thus produced, and from the liability to œdema that is
aus induced. By reason of the arrest of nutrition that follows a
olution of continuity between the perichondrium and the subjacent
artilage, the affected portion of the laryngeal cartilage falls into a con-
ition of necrosis which may result in its absorption or in the discharge
detached portions of necrosed tissue. In this way, an additional
ource of deformity and constriction of the laryngeal cavity may be
riginated.

Symptoms. When *perichondritis* occurs as a secondary consequence
other laryngeal diseases, its symptoms are liable to confusion with
ose of the primary disease; only when it occurs as a primary inflam-
ation is it easy to recognize its characteristic phenomena.

When the disease is limited within a narrow space, there is com-
aint of a localized pain, which, when it principally involves the pos-
ior portion of the larynx, is increased during the act of deglutition.
hen the external surfaces of the larynx are affected, there may be
elling and redness of the superficial tissues in the neck, with pain on
ssure over the thyroid cartilage. The neighboring lymphatic glands
y also participate in the swelling. The voice is generally affected by

reason of the swelled and obstructed condition of the laryngeal orifice, or as a consequence of difficulties affecting the muscular apparatus of the organ. The act of respiration is also impeded by the production of inspiratory dyspnœa.

The laryngoscopic mirror renders it easy to locate the site and the nature of the process by which the above-mentioned symptoms are produced, when the degree of swelling is sufficient to obstruct the glottis.

The course of laryngeal perichondritis exposes the patient to great danger. The sudden evacuation of an *abscess*, or the occurrence of complicating *œdema* of the *glottis*, may occasion asphyxia and sudden death. *Fistulous openings* sometimes remain as an indication of previous necrosis involving the laryngeal cartilages. In some cases a communication with the cavity of the larynx has thus been opened directly through the tissues and skin of the neck. *Septicæmia* and *pulmonary abscess* or *gangrene*, or chronic pulmonary diseases, may be excited as a consequence of purulent infection. Complete cessation of the inflammatory process, with local cicatrization, sometimes only adds to the dangers of the patient by the deformity and constriction of the larynx that may be thus produced. The prognosis is therefore very unfavorable.

TREATMENT. Local inflammation without suppuration requires local antiphlogistic treatment, *e. g.*, ice-bags over the larynx, small pieces of ice internally, and the application of three or four leeches over the thyroid cartilage, or lower down, if it be desirable to conceal the scars. Counter-irritation with tincture of iodine or with croton oil may be employed as the case progresses Syphilitic patients require active treatment with iodide of potassium, five to ten grains three times a day; or the inunction of mercurial ointment daily for a month. Pain may be relieved by pencilling the epiglottis and the cavity of the larynx with a ten per cent. solution of cocaine. The formation of abscesses require surgical interference with a properly guarded bistoury, guided by the aid of the laryngoscopic mirror. After the evacuation of the abscess, the patient should inhale disinfectant sprays, *e. g.*, two or three per cent. solutions of carbolic acid, boric acid, benzoate of sodium, or the liquor aluminii acetici. The symptoms of asphyxia must be obviated by intubation or by tracheotomy. Severe laryngeal stenosis may render it necessary to wear the tracheal canula during the remainder of life.

CHAPTER III.

LARYNGEAL NEUROSES.

ysis of the Laryngeal Muscles—Paralysis Musculorum Laryngis.

OLOGY. *Laryngeal paralysis* may be the consequence either of is disorder or of disease involving the muscular structures them-

The first class of affections is dependent upon diseases of the l nervous system or of the peripheral nerves, and may be associated ther evidences of paralytic disorder. The nature of the second nay remain obscure until death permits microscopical examination affected tissues.

yngeal paralysis of *nervous origin* often occurs in consequence ebral hemorrhage, but more frequently in connection with chronic legeneration affecting the pons Varolii or the medulla oblongata, nultiple cerebro-spinal sclerosis, glosso-labio-laryngeal paralysis, dorsalis, etc. It is frequently observed as a functional disorder in ical affections, or as a result of reflex inhibition. Rheumatic sis of the laryngeal muscles not uncommonly occurs among is persons who are predisposed to muscular rheumatism.

ong *peripheral causes* of *laryngeal paralysis* may be mentioned currence of *tumors* within the cavity of the cranium that press the roots of the pneumogastric nerve, or upon its trunk when d within the neck or within the cavity of the thorax. In like r the accumulation of liquids within the pericardium or the l cavity may compress the recurrent nerves and thus interfere he movement of the laryngeal muscles.

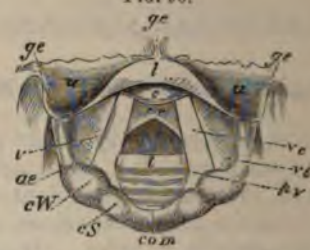
al inflammation involving the laryngeal cavity, and previous *ion* with the contagion of infective diseases, notably *diphtheria*, *ntoxication* with *lead*, *opium*, and *solanaceous preparations*, are ered among the exciting causes of laryngeal paralysis.

THOLOGICAL ANATOMY. In many cases no changes can be dis- d either in the nerves or in the muscles of the larynx; the patho- l changes must be sought in the brain or elsewhere. In other the phenomena of chronic inflammation and degeneration may be ered in the muscular tissues.

IPTOMS. It is impossible to recognize with certainty the exist- f laryngeal paralysis without the aid of the laryngoscope, since re so many causes of a non-paralytic character which may inter- ith the functions of the organ. (Fig. 96.) It must not be for- that the muscles of the larynx are innervated by the pneumogas- nd spinal accessory nerves whose united fibres supply, through perior and inferior laryngeal nerves, the requisite innervation to sory and motor structures of the organ. The *superior laryngeal* is the *sensory nerve* of the upper portion of the laryngeal cavity,

and of the vocal cords, and it also supplies motor twigs to the crico-thyroid muscle, and to the thyro-ary-epiglottic muscle by which the epiglottis is drawn backward over the glottis. The *inferior laryngeal nerve* is the *motor nerve* for all the other muscles of the larynx.

FIG. 96.



The laryngeal image during quiet inspiration. *ge*. Glosso-epiglottic folds. *a*. Upper surface; *l*, lip, and *c*, cushion of epiglottis. *v*. Ventricle of larynx. *ae*. ary-epiglottic fold. *cW*. Cartilage of Wrisberg. *cS*. Capitulum Santorini. *vc*. Vocal cord. *t*. Tracheal rings. (MORELL MACKENZIE.)

Paralysis of the *laryngeal muscles* may be either unilateral or bilateral; it may involve a single muscle, or special groups of muscles, or all the muscles of the organ.

(*a*) *Paralysis of the posterior crico-arytenoid.* With the laryngoscope it is easy to discover that paralysis of this muscle arrests the movements of the corresponding vocal cord. In cases of bilateral paralysis the vocal cords are not separated during the act of inspiration, but remain almost in contact with each other, thus producing noisy inspiration which may be succeeded by complete obstruction, if associated with slight swelling of the mucous membrane.

(*b*) *Paralysis of the arytenoid muscle* prevents the contact of the posterior third of the vocal cords during the act of articulation, in consequence of the impossibility of approximating the arytenoid cartilages so as to close the posterior portion of the glottis.

(*c*) *Paralysis of the internal thyro-arytenoid muscle* prevents the approximation of the anterior two-thirds of the vocal cords during the act of phonation.

(*d*) *Paralysis of the lateral thyro-arytenoid muscle*, and

(*e*) *Paralysis of the external thyro-arytenoid muscle*, do not permit of recognition by the aid of the laryngoscope.

(*f*) *Paralysis of the entire recurrent nerve* produces complete immobility of the corresponding vocal cord, which remains motionless in a position half-way between the median line of the glottis and the position which it normally occupies during inspiration. (Figs. 97 and 98.) This position corresponds with that which is assumed by the margin of the glottis after death, hence the term *cadaveric position* applied to this paralytic state. Respiration obviously encounters no obstruction during the act of phonation. The opposite vocal cord, in cases of unilateral paralysis, extends itself beyond the median line so as to render utterance possible, though rough and difficult. The unparalyzed arytenoid cartilage also presses in front of and beyond its companion.

g) Paralysis of the crico-thyroid muscle. The crico-thyroid muscle sts in the extension of the vocal cords, by which the pitch of the e is elevated. Paralysis, therefore, prevents such elevation of the h. Laryngoscopic examination discovers nothing of a characteristic ire.

h) Paralysis of the thyro-ary-epiglottic muscle. This muscle is ervated by the superior laryngeal nerve, and it acts as the depressor scle of the epiglottis. Bilateral paralysis prevents the depression of epiglottis during the act of swallowing, so that foreign substances liable to intrude themselves within the larynx. In this way great ation may arise, with cough and subsequent inflammation, and the luction of abscess or gangrene in the lungs, if foreign bodies find r way into the deeper respiratory passages. Such intrusion is more le to follow complete paralysis of the superior laryngeal nerve, be- se the consequent loss of sensibility in the upper part of the larynx lers those reflex movements by which the glottis may be closed.

FIG. 97.



alysis of the left recurrent nerve. ge during inspiration—the left cord he cadaveric position. (MORELL MAC- ZIE.)

FIG. 98.



Paralysis of the left recurrent nerve. Image during phonation—left cord in ca- daveric position. (MORELL MACKENZIE.)

Functional paralysis and *intermittent paralysis* of the laryngeal scles have been observed as consequences of hysteria and of malarial ection.

PROGNOSIS. The probability of recovery depends upon the nature d cause of the disease. Paralysis of the posterior crico-arytenoid scles is attended with the greatest amount of danger by reason of the nsequent liability to asphyxia.

TREATMENT. Treatment must be prophylactic, general, and local. ophylactic and general measures should be addressed to the invigora- n of the constitution and to the prevention of disorders that may come complicated with paralysis. Quinine, iron, strychnine, and senic, are the most efficient remedies in connection with general atment.

Local treatment consists chiefly in daily pencilling of the laryngeal faces with weak solutions of nitrate of silver, or in the daily insuffla- n of astringents (p. 429), and the employment of electricity. The dic current may be applied externally with just sufficient strength effect contraction when applied to the facial muscles; or it may be lied directly to the paralyzed muscles by means of a laryngeal elec- le, guided by the aid of the laryngoscopic mirror. Hysterical paral- may be sometimes very promptly and unexpectedly relieved by the

use of powerful electrical currents, or by some strange and unexpected manœuvre that arouses the attention of the patient.

Impending asphyxia, dependent upon paralysis involving the posterior crico-arytenoid muscles, must be relieved by intubation or by tracheotomy. Paralysis of the depressor muscles of the epiglottis may render it necessary to resort to artificial feeding with the aid of an œsophageal sound.

Spasm of the Glottis—Spasmus Glottidis.

Etiology. *Spasm* of the *glottis* is a functional disease that is characterized by the occurrence of brief paroxysms during which the opening of the glottis is spasmodically closed, and respiratory movements are arrested. It is most frequently encountered during the first two years of life, among male children who are the victims of rickets or of tuberculosis of the lymph glands. It occurs, therefore, among bottle-fed babies who manifest the restless irritability and unhealthy nutrition which characterize the rickety constitution.

Symptoms. *Paroxysmal arrest* of *respiration* constitutes the prominent symptom of spasm of the glottis. Respiration suddenly becomes irregular and shallow; then, after a few deep inspirations, the breath ceases; the child becomes pale or cyanotic, with feeble and irregular movements of the heart, and swelling of the veins in the neck; sometimes there is involuntary evacuation of urine and feces; the diaphragm is depressed and motionless, and the patient appears as if at the point of death, when, suddenly, with a long, deep, and stridulous inspiration, breathing is renewed; the child opens his eyes, and soon appears as well as ever. The whole paroxysm occupies but a few seconds, or half a minute, at the longest. The paroxysms may be of rare occurrence, or they may be repeated many times a day.

The occurrence of spasm is not always limited to the respiratory muscles, but it sometimes extends to the extremities of the body, with the production of *convulsive movements* that mark a relationship between this disorder and general convulsions. *Death* sometimes occurs as a result of asphyxia.

Pathological Anatomy. Post-mortem examination indicates a great variety of pathological disorders, involving the lymphatic system and the circulation of blood; but nothing that is uniformly characteristic or explanatory of the spasmodic phenomena. The disorder appears to be a neurosis that depends upon reflex excitement associated with central or peripheral errors of nutrition.

Prognosis. The prognosis in cases of spasm of the glottis must be very guarded. Danger arises not so much from the occurrence of spasm as from the cachectic condition of the patient.

Treatment. Prophylactic treatment requires the adoption of such measures as will improve the nutrition of the patient. Nurslings who are deprived of mother's milk should be provided with a wet-nurse, and unwholesome hygienic conditions must be rectified as far as possible.

On the occurrence of a paroxysm the child must be placed in the erect position, because pressure upon the back of the head frequently provokes or prolongs the spasm. A warm bath, and sprinkling of the face

h cold water, are useful. If the paroxysm be unusually prolonged, mouth should be opened, and the attendant should endeavor with forefinger to draw the tongue forward, and thus to arrest the spasm. repetition of the attack may call for the administration of ether, or chloral. Intubation may become necessary, and will, probably, if ployed, obviate the necessity for tracheotomy. The use of faradic ctricity about the neck and diaphragm has been recommended. omide of potassium may also be employed with advantage, especially associated with attention to the diet and digestive organs.

A somewhat similar **spasmodic affection of the laryngeal muscles** is metimes observed among hysterical adults, or as a consequence of drophobia, or lead poisoning, or the pressure of tumors upon the anches of the pneumogastric nerve, or after the inspiration of irrita- g gases, or the introduction of foreign bodies within the cavity of the rynx. Nervous persons, under the influence of fatigue and excite- ent, sometimes manifest, during paroxysms of cough, a tendency to ryngeal spasm that may be distressing or even dangerous. Under ch circumstances accurate coördination of the laryngeal muscles may come temporarily attended with difficulty, so that articulation is per- rmed in an imperfect manner, or fails entirely, for the time being. uch conditions are obviously aggravated by the intercurrence of slight tarrhal inflammation of the laryngeal mucous membrane.

Anæsthetic conditions of those portions of the mucous membrane hat lie under the control of the superior laryngeal nerve are sometimes bserved after diphtheria, or during the course of glosso-labio-laryngeal paralysis. The affection sometimes occurs in connection with hysteria. As a consequence of such anæsthesia, particles of food are very liable o find their way into the respiratory passages, where they may excite evere inflammation.

Hyperæsthesia of the laryngeal mucous membrane is sometimes ob- erved among nervous patients who have over-exerted their vocal organs. In such cases a sensation of burning pain, or of tickling, in the region of the larynx may rise to the level of severe neuralgia. It must be relieved by the use of narcotics, and by restoration of the general health of the patient.

Laryngeal cough is most frequently observed among young women of an hysterical predisposition. The cough is paroxysmal, and some- times assumes a peculiar hoarse and muffled sound, that is frequently compared to the barking of a dog.

CHAPTER IV.

DISEASES OF THE TRACHEA AND BRONCHI.

Catarrhal Inflammation of the Bronchi—Bronchitis Catarrhalis.

ETIOLOGY. *Catarrhal inflammation of the trachea* is so intimately associated with inflammation of the bronchi, and its symptoms are so nearly overshadowed by the symptoms and causes of bronchitis, that it is unnecessary to consider them apart from those of bronchial inflammation. Bronchitis may involve the air passages upon one or upon both sides of the thorax; it may be limited to a single bronchus, or it may involve every branch of the bronchial tree; it may occur as a primary disease, or it may arise as a complication of many other diseases.

The most common cause of primary bronchitis is *exposure* to *dampness* and *cold*. It often occurs in the spring and fall of the year, when the weather is exceedingly variable and damp. It occurs most frequently at the extremities of life. Many persons exhibit a *predisposition* to *inflammation* of the *respiratory mucous membrane*, and are liable to attacks of bronchitis under circumstances which would excite some other form of inflammation, or would produce no result whatever, in the case of other individuals who were subjected to the same kind of exposure. The existence of anæmia, or tuberculosis, or the rickety diathesis, is a powerful predisposing cause of the disease. Patients who have been debilitated by malaria, syphilis, Bright's disease, diabetes, gout, scurvy, or alcoholism, present very little resistance to the exciting causes of bronchial inflammation.

Prominent among exciting causes of bronchitis is the *respiration of air* that is *charged with irritating gases*, or loaded with particulate dust. For this reason many occupations are especially dangerous to artisans or laborers.

Without mentioning the deleterious effects that result from inhalation of certain chemical gases and vapors, it is worthy of note that *particular drugs* sometimes excite severe bronchial inflammation when they are administered for medicinal purposes. Thus it is frequently impossible to make use of ipecacuanha, or iodide of potassium, or of bromide of potassium. Mercurial preparations sometimes appear to excite a similar tendency.

It is doubtful whether vocal exercises can produce bronchial inflammation by any direct effect upon the mucous membranes; it is more likely that the frequent occurrence of bronchitis among such subjects is the result of incautious exposure after becoming very much heated by vocal effort.

Secondary bronchitis usually occurs as the result of *pulmonary diseases*, or in consequence of obstruction to the circulation which has

origin in *heart disease* or in such disorder of the *abdominal organs* hinders the efficient circulation of the blood.

The occurrence of bronchitis as a complication of *laryngeal inflammation*, or as a sequel of the *infective diseases*, has already been mentioned.

Pathological Anatomy. In *acute bronchitis* the mucous membrane that lines the bronchi exhibits unusual redness and swelling; sometimes the larger bloodvessels become visible to the naked eye; and, occasionally, minute extravasations of blood are visible under the epithelial surfaces. At first the mucous membrane appears velvety and unusually dry; but, presently, the secretion of the mucous glands becomes copious, and their ducts are distended with minute, pearly drops, which exude into the bronchial passage, and cover its surface with a thick, transparent, and slimy liquid. If the inflammation involves the smaller bronchioles, they may become completely obstructed by this secretion so that air can with difficulty enter the alveolar passages, and cannot escape from them during expiration. The lungs, in consequence, become expanded and emphysematous; this change is most commonly observed along the anterior border and inferior surface of the pulmonary lobes. Sometimes a considerable bronchus becomes obstructed, with subsequent collapse of the dependent portion of the lung tissue, constituting what is called *atelectasis*. This differs from other diseases that are characterized by the absence of air in the pulmonary alveoli through the fact that the collapsed portion of the lung may be easily filled with air by insufflation through the obstructed bronchus. But, sometimes, it happens that the alveoli are themselves occupied by inflammatory exudations as a consequence of an extension of the inflammatory process from the adjacent bronchioles, constituting *catarrhal pneumonia* or *broncho-pneumonia*.

An incision through the lungs, after death from catarrhal bronchitis, discloses a discharge of frothy, or more or less sero-purulent, liquid from the smaller bronchial passages.

Chronic catarrhal bronchitis is limited to the larger bronchi; their mucous lining is considerably thickened, and exhibits a darker color than that which characterizes acute bronchitis. The *mucous membrane* presents extensive proliferation of tissue, especially involving the elastic layers, while the muscular fibres are considerably atrophied. Sometimes, in chronic cases, the mucous membrane becomes very thin and pale, so that it resembles a serous membrane in its general appearance. The *bronchial secretions* present variable characteristics, being sometimes thick and tenacious and richly endowed with pus corpuscles, or they may be of a thin and watery quality; sometimes decomposition takes place within the bronchi, and the sputa become putrid and horribly offensive.

Sometimes the inflammatory process extends beyond the mucous membrane, and invades the *peribronchial connective tissue*, exciting interstitial inflammation of the lungs. Sometimes the *lymphatic vessels* and bronchial *lymph glands* are thus invaded. *Pulmonary emphysema* may also develop as a consequence of chronic bronchial catarrh.

SYMPTOMS. *Acute inflammation of the larger bronchi* commences with a sensation of soreness under the sternum, accompanied by an inclination to cough, but without any considerable amount of expectoration. A febrile movement is not uncommon, and among children it may be attended by severe symptoms of cerebral disturbance, or by convulsions.

Auscultation reveals the existence of coarse râles which are audible between the shoulder-blades and in the lateral portions of the thorax. These sounds are produced by the occurrence of local accumulations of mucus upon the inner surface of the bronchi, by which the movement of the air, during respiration, is somewhat obstructed, and audible sounds are originated. When the secretion is scanty and tough, the râles are of a sonorous and simple character, which is indicated by the term *dry râle* or *rhonchus*. A *moist râle* indicates the presence of a less tenacious and more fluid secretion. When inflammation invades the smaller bronchi, the râles become finer, and assume a whistling or hissing character, hence the term *sibilant râle* that is applied to such sounds. When these sounds originate near the surface of the lung, they are clear and audible, but when originating in the deeper portions of the organ, they assume a somewhat muffled character; they never manifest a resonant quality.

As the disease progresses, the *bronchial secretions* become more copious and exhibit an increasing quantity of pus cells in the semi-fluid mass. The originally mucous sputa thus become transformed into muco-purulent or sero-purulent accumulations. The character of the *respiratory sounds* indicates a similar transformation. Dry and sonorous at first, the râles become moist and sibilant as the process of liquefaction goes on. The respiratory sound frequently becomes prolonged in consequence of obstruction to the outflow of air through the constricted bronchi. Inspiratory sounds lose their delicate vesicular quality and become coarse and shrill, with staccato-like intermissions, in consequence of interference with the normal vibration of the bronchial membranes.

The *cough* by which the patient is annoyed is severe in proportion to the amount of inflammation at the bifurcation of the trachea, which has been experimentally shown to be the most irritable portion of the bronchial tree. At first, expectoration is very scanty, but with the progress of the disease it becomes copious, and the sputa exchange their tenacious, frothy, and glairy transparency for a more fluid and purulent quality. As the disease subsides, cough and expectoration diminish, and finally cease altogether. During the height of the cough a certain degree of hoarseness is sometimes observed. The intercostal and abdominal muscles sometimes become tender and painful, in consequence of the excessive efforts that are required of the respiratory muscles. In severe cases, vomiting, or the involuntary evacuation of urine and feces, may occur during paroxysms of cough; hernia, prolapse of the anus, and premature delivery, have also been thus occasioned; not unfrequently the return of blood through the jugular veins is hindered during the paroxysms of cough to a degree that produces headache, dizziness, noises in the ears, and other evidences of venous hyperæmia

thin the cranium. The duration of the disease is seldom more than
e or two weeks.

Acute catarrhal inflammation of the bronchioles, sometimes called
illary bronchitis, is produced by the extension of the inflammatory
ocess to the ultimate branches of the bronchial tree. It is attended
h great danger, especially when it attacks old people or young chil-
n. During the infantile period of life, the bronchiole is relatively
aller than it is at a later period, consequently there is greater risk of
obstruction through inflammatory swelling of its mucous lining. The
ease is also, among children, more liable to degenerate into a condition
catarrhal pneumonia; among old people the danger generally arises
m the tendency to exhaustion and asphyxia.

The commencement of the disease is frequently associated with the
linary symptoms of acute bronchitis; in other cases it develops
idiously. The accompanying *fever* presents no characteristic features,
ough there is usually a morning remission, or a brief intermission.
spiration is hurried in proportion to the extent and severity of the
lammation. *Expiration* is prolonged, and, with children, is fre-
ently terminated by a slight groaning sound. *Auscultation* discovers
er the greater portion of the thorax, fine subcrepitant râles, some-
nes associated with the coarser sounds that originate in the larger
onchi. When the bronchioles are considerably obstructed, the thoracic
lls exhibit considerable *retraction during inspiration*. This is
pecially conspicuous among children, because of the yielding character
their tissues. The occurrence of this symptom indicates that very
tle air finds its way into the pulmonary alveoli, and that the lung is
ry imperfectly expanded during inspiration, so that the superincumbent
essure of the atmosphere causes a compensatory depression of the
oracic walls; sometimes this affection of the lower portion of the
orax is associated with alveolar distention of the upper part of the
ngs, caused by the imprisonment of inspired air which cannot escape
ring expiration. These respiratory difficulties serve to arouse the
tivity of the auxiliary muscles of respiration. The nostrils are ex-
nded at the commencement of each inspiration, the head is drawn
ckward, the mouth is opened, the shoulders are elevated, and the
ctoral and cervical muscles become tense. During expiration the
dominal muscles are also called into excessive action; it becomes im-
ssible to lie down; grown persons must sit up in bed, and infants
ist upon being carried erect in their mother's arms. As the proper
ygenation of the blood diminishes, the patient becomes cyanotic, con-
ousness is clouded, and the phenomena of *asphyxia* terminate the
rse of the disease.

Palpation and *percussion* of the thorax afford comparatively little
ormation regarding the nature of the disease; sometimes the vocal
mitus manifests trifling changes, and the occurrence of acute emphy-
ma, along the anterior and lower borders of the lungs, may occasion
increased resonance on percussion. Circumscribed dulness that does
disappear after deep inspiration indicates the existence of broncho-
eumonia. *Auscultation* discovers a fine, inspiratory, sibilant râle.

Vocal sounds remain unchanged, unless the large bronchi have become completely obstructed.

The *cough* that accompanies capillary bronchitis is less severe than when the larger bronchi are inflamed. The sputa are, at first, similar to those which are expectorated during the early stage of acute bronchitis; with the progress of the disease they assume a muco-purulent character; floating in water, they exhibit stringy processes which correspond with the finer ramifications of the bronchial tree.

The *heart* sometimes exhibits dilatation and increased dulness on percussion affecting the right ventricle, in consequence of impediment to the passage of blood through the branches of the pulmonary artery. If the anterior portion of the lung become over-distended with air, the area of cardiac dulness will be somewhat diminished. If the obstruction of the pulmonary circulation reach a high degree, the *liver* and *other organs* may become enlarged through retrograde blood pressure.

The *duration* of the disease varies from a few days to a number of weeks.

Chronic catarrhal bronchitis can originate spontaneously or it may be the result of an acute attack. It chiefly occurs among elderly people who suffer with obstruction of the circulation, or whose occupation exposes them to the inhalation of dusty particles. Its course is most frequent during the cold, damp months of the year. The disease seldom exhibits any symptoms of fever, unless as a transitory sequence of acute exacerbations.

Chronic bronchitis usually affects the *larger bronchi*, consequently the râles that indicate its existence are coarse and sonorous, dry or moist. If the disease is associated with difficulty of respiration, the sterno-cleido-mastoid muscles sometimes exhibit considerable hypertrophy; the veins in the neck also become dilated, and, sometimes, exhibit visible pulsations. Under such circumstances the *right side* of the *heart* becomes dilated and hypertrophied, and in the later stages of the disease the usual consequences of obstructed circulation become manifest, *e. g.*, œdema, dropsy, albuminuria, etc. The cardiac muscles may undergo fatty degeneration as a consequence of the deficiency of oxygen in the blood in connection with the inordinate amount of work that is laid upon them. *Inflammation* of the *lungs* sometimes occurs, or the patient may simply fall into a hectic condition, and gradually waste away. *Pulmonary consumption* sometimes terminates life.

As a consequence of chronic bronchitis it sometimes happens that the *bronchi* become *dilated;* in other cases the *air cells* are distended, producing *emphysema* of the lungs. Occasionally the bronchial secretion undergoes putrefaction which may lead to *gangrenous processes* in the *lungs*.

The disease tends to become more and more firmly established, and may continue for many years, or throughout the whole course of life.

Certain varieties of bronchitis require special notice.

(*a*) *Dry bronchitis* is a chronic form of bronchial catarrh, characterized by scanty, tenacious and gray sputa; it is usually observed in old people, and frequently results in the production of emphysema.

(*b*) *Simple bronchorrhœa* is characterized by very copious sputa,

-purulent character, of a greenish color, and somewhat frothy; it of discharge affords no indication regarding the severity of e.

ous bronchorrhœa is characterized by the expectoration of transparent, colorless, and frothy sputa; it is often associated rtain amount of dyspnœa of an asthmatic character, which is ly relieved by severe paroxysms of cough and copious expec-

oncho-blennorrhœa is characterized by the expectoration of sputa, richly charged with pus corpuscles, fatty granules, and the discharge differs from the contents of a pulmonary abscess the absence of elastic fibres and pulmonary tissues in the ted masses.

trid bronchitis is characterized by the expectoration of sputa the process of putrefaction has been set up by the action of ve bacteria. The stench that is exhaled by the patient is and, sometimes, suffices to destroy the appetite on the part of er; the odor differs from that of ordinary foul breath by its ungency and pervasiveness. The sputa are generally very fluid, gray or brown in color; if allowed to stand for some dish, the mass separates into four quite distinct layers, of superficial layer is frothy, the middle layers are serous, and resembles a sediment in which are found the characteristic which contain bacteria. *Microscopical examination* indicates, h pus corpuscles, a fatty, pigmentary débris, various micro-, and the presence of the parasite, Leptothrix pulmonalis. ice of tissue cells derived from the parenchyma of the lungs certain indication that the offensive odor is not due to gangrene. ral condition of the patient, also, is inconsistent with the pros- nd rapid destruction that accompany gangrenous processes. an uncommon thing, however, for putrid bronchitis to excite a ve fever, and to terminate life with the symptoms of uncon- liarrhœa or hemorrhage.

OSIS. The diagnosis of *catarrhal bronchitis* seldom presents l difficulty. The characteristic symptoms are few in number; ice of *râles*, *diminution* of the *respiratory sounds*, *high-pitched mitting vesicular inspiration*, *prolonged expiration*, and *ab- dulness* on *percussion*, are sufficient to decide the diagnosis. *âles* indicate the larger bronchi as the seat of the disease; *âles* originate in the smaller bronchi, while still *finer râles* he extension of disease into the capillary bronchi; *dry râles* he existence of tenacious secretions; while *moist râles* indicate id character. *Acute* and *chronic bronchitis* may also be dif- d by their mode of commencement, and by their duration. ty of the sputa is not without significance.

itis may be differentiated from *pneumonia* by the absence both on percussion, bronchial breathing, crepitant râles, increased ony, and vocal fremitus.

itis may be differentiated from *dry pleurisy* by the disappear- pparent friction sounds immediately after the paroxysms of

cough, which have no influence upon genuine friction sounds. Pressure with the stethoscope upon the thoracic wall, moreover, produces no change in the bronchial sounds, while it considerably increases the intensity of pleuritic sounds.

PROGNOSIS. The results of bronchial catarrh are exceedingly variable. Among old people and children the acute disease is attended with great danger. Capillary bronchitis, also, is a dangerous disease. The occurrence of complications renders the prognosis much more serious. Chronic forms of the disease are less likely to recover than the acute forms.

TREATMENT.—Since bronchitis frequently implies a certain predisposition on the part of the patient, it is desirable to employ measures that tend to increase his powers of resistance. Daily sponging with cold water, the use of the flesh-brush, abundant exercise in the open air, with proper regulation of the diet, and avoidance of the exciting causes of the disease, are the principal measures that require attention. The existence of rickets, chlorosis, anæmia, marasmus, or a predisposition to tuberculosis, or arthritic diseases, must be corrected as far as possible.

At the outset of an acute bronchitis the ordinary antifebrile treatment with antipyrine, acetanilide, or phenacetine may be undertaken in association with hot-foot baths, sinapisms, etc. Cough may be allayed by small doses of opiate remedies, *e. g.*:

℞.—Pulv. ipecac. et opii gr. v.
S.—One such powder three times a day.

℞.—Morph. sulph. gr. j.
Acid. hydrocyan. dilut. ℥xxx.
Syr. simpl. ʒss.
Aq. destill. ʒiijss.—M.
S.—A teaspoonful every one or two hours.

Narcotics must, however, be given with great caution to children, and should never be administered if any cyanotic appearances are present.

If abundant râles indicate copious secretion, it will be desirable to administer expectorant remedies:

℞.—Ammon. chlorid. ʒjss.
Syr. ext. glycyrrhiz. ʒiv.—M.
S.—A teaspoonful every two hours.

℞.—Apomorphin. gr. j.
Aquæ ʒvj.—M.
S.—A teaspoonful every two hours.

℞.—Potass. iodid. ʒss.
Syr. ipecac. ʒj.
Aquæ ʒiij.—M.
S.—A teaspoonful every two hours.

As expectoration becomes more copious, especially if associated with a harassing cough, various combinations of narcotics and expectorants will be found useful.

℞.—Morph. sulph. gr. iij.
Spts. chloroform. }
Tr. cannab. ind. } āā ʒj.
Tr. hyoscyam. }
Acid. phosphor. dilut. } āā ʒiij.
Syr. ipecac. }
Syr. scillæ } āā ʒvj.
Glycerin. ℥ijss.—M.
Half a teaspoonful every two hours.

℞.—Acid. benzoic. gr. jss.
Ext. belladon. gr. ½.
Sacch. lact. gr. viij.—M.
One such powder every four hours.

room in which the patient lies should be kept at a temperature F., and the air should be moistened with the vapor of hot water. al to recommend the addition of lime-water, or solutions of the salts, to the water that is diffused in the form of spray through- apartment. Oil of turpentine, carbolic acid, and tar-water may employed. The direct inhalation of such medicated sprays, if l frequently, is often serviceable; the strength of the solution mployed should not exceed one or two per cent.

obstruction of the bronchial passages may sometimes call for ough the aid of emetics (ipecacuanha, tartar emetic, sulphate of apomorphine, etc.). Their use should not be deferred until has deadened the reflex centres in the medulla oblongata, for emetic action often fails to occur. The administration of alco- mulants a short time before the emetic dose often adds to its r. Great prostration must be antagonized by the use of stimu- .*g.*, wine, camphor, musk, aromatic spirits of ammonia, etc. ple often require supporting treatment from the outset of the

lewhat relaxed condition of the bowels often affords great relief, y to young children; for this purpose calomel in association sulphide of antimony may be given, either in the form of r's pills, or in the form of a powder:

℞ —Calomel. }
Stibii sulphid. } āā gr. j
Sacch. lact. gr viij.—M.
One such powder three times a day for an adult

nstruction regarding the employment of pneumo-therapeutic in the treatment of bronchitis, the student is referred to nonographs on the subject.

reatment of chronic bronchitis often requires change of climate pation on the part of those who are able to secure such advan- Long sea voyages, residence upon the sea-shore, and salt-water e often found efficacious. Alkaline sulphur waters, and the tinued use of small doses of sulphur, exert a favorable influ- rheumatic cases. During the summer season patients may be advantage to the mountainous regions in New England, in the acks, and along the line of the Alleghany Mountains, or to the regions of Colorado, New Mexico, and Arizona. During the

winter the coast of the Gulf of Mexico, and the inland resorts in Georgia and the Carolinas, afford a desirable residence.

The occurrence of pain in the chest may be relieved by warm applications and stimulating liniments, or dry cups; in severe cases the hypodermic injection of morphine and atropine may be required. The occurrence of hæmoptysis may be checked by hypodermic injections of ergotine, or by the administration of lead and opium pills. Asthmatic paroxysms are favorably influenced by the use of iodide of potassium.

℞.—Potass iodid. ʒij.
Syr ipecac
Glycerin. } āā ʒij.—M.
Aquæ

S.—A teaspoonful every three hours.

Excessive secretion and expectoration may be relieved by the inhalation of balsamic remedies, and by their internal use.

℞.—Ol. terebinth. ʒj.

S.—Ten or fifteen drops, in milk, three times a day.

℞.—Terpin. hydrat. ʒj.
Tabell. no. xxx.

S.—One tablet every three hours.

Putrid bronchitis requires the treatment that will be recommended in cases of pulmonary gangrene.

Fibrinous Bronchitis—Bronchitis Fibrinosa.

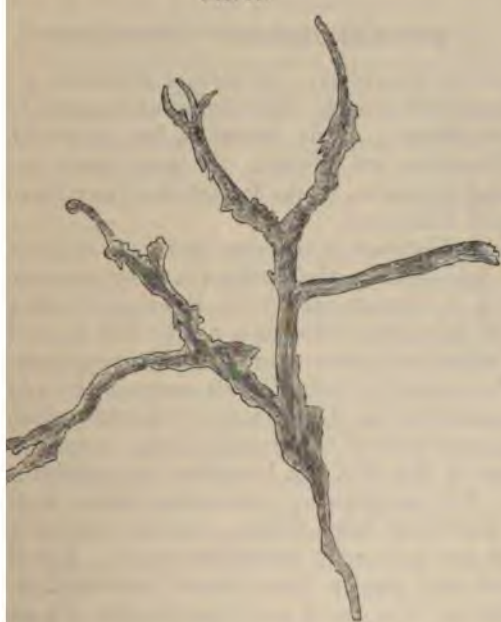
Etiology. Fibrinous bronchitis consists in the formation of fibrinous casts within the small bronchi. Such exudation sometimes occurs as a primary disease, but in other cases it is a secondary consequence of previous inflammation either in the larynx or in the air cells of the lungs. The primary disease originates in the bronchi, and may extend thence either into the larynx or into the air cells. It is a very rare disease. It commonly results from *exposure* to *cold;* but it has been observed in connection with *infective diseases*, and as a consequence of *pregnancy*, or of *menstruation*. It has also been observed in alternation with *eruptions* of impetigo, herpes, or pemphigus *upon the external surface of the body*.

Symptoms. *Fibrinous bronchitis* may exist as an acute or as a chronic disease. The *acute form* seldom lasts longer than a fortnight, but the *chronic variety* may continue for many years, with a more or less remittent course. The acute disease is much more dangerous than the chronic, on account of the danger of extensive obstruction of the air passages and consequent asphyxia. It is prone to attack the larger bronchi, and to extend into the larynx, while the chronic disease is chiefly manifested in the smaller air passages.

The characteristic symptom in both forms of the disease is the *expectoration of branching casts* which are formed by fibrinous exudation from the bronchial mucous membrane. Previous to such expectoration the symptoms of bronchial obstruction and of asphyxia are manifested

ce with the extent of the exudation. *Death* sometimes
cases, before the discharge of any of the membranes.
of serious symptoms is generally preceded by the ordi-
f bronchial catarrh; these may increase until hæmoptysis
he discharge of the cast; its evacuation is followed by
of these symptoms, which, however, may be renewed in
xudation.
struction of the larger bronchi may occasion inspiratory
he *thoracic wall*; it will also be indicated by loss of
ffected part, diminished vocal fremitus, and the disap-
piratory sounds, with persistence of resonance on per-
ess on percussion does not exist unless the air cells of
vaded by the inflammatory process, or when some por-
becomes collapsed.
ns of the casts are subject to great variations; sometimes
and almost lost in the sputa; in other cases they may
e length of the bronchial tree. (Fig. 99.). The larger

Fig. 99.



f bronchi; drawn full size, but the cast was slightly shrunken by
N Wilson.)

ually hollow, and contain muco-purulent matter, but the
es are solid, and have, occasionally, undergone calcifica-
r is white, gray, or brownish, according to the amount of
nters into their composition. The tubes are formed of
llæ which consist of hyaline, fibrinous exudation, among
hich are entangled a few round cells, fatty granules, and

the débris of blood corpuscles. Various forms of epithelium are sometimes adherent to the mass.

Expectoration of the casts is followed by considerable relief from the preceding symptoms. Sometimes a single attack ends the disease, but generally the process of exudation is continued with repeated formation and evacuation of the resulting casts. If death occur, the bronchial mucous membrane appears red and swollen; very rarely is the opposite condition discovered. The epithelium beneath the casts sometimes remains uninjured, but it is often completely removed.

PROGNOSIS. The prognosis in such cases is very doubtful, and must be given with great caution.

TREATMENT. The removal and expectoration of the casts is facilitated by constant inhalation of warm vapor, to which may be added one per cent. of any one of the alkaline salts, or two per cent. of lactic acid, or five per cent. of papayotine or of neurine. Expectorants, or emetics, may be used to assist in the discharge of the loosened casts (p. 444). Mercurial preparations and iodide of potassium are recommended as remedies for the arrest of exudation.

Bronchial Dilatation—Bronchiectasis.

PATHOLOGICAL ANATOMY. *Bronchial dilatation* is usually observed in the medium-sized bronchi of the lower and middle lobes of the lungs. It sometimes affects a single bronchus, but generally a considerable number of branches are affected. It may result, as in the analogous case of arterial dilatation, in the formation of sacculated, cylindrical, or spindle-shaped dilatations.

Cylindrical dilatation is characterized by a uniform swelling of the bronchus. *Spindle-shaped dilatation* may be associated with the previous form; it is characterized by a tapering course of the expanded portion of the bronchus; sometimes a tube may be in different portions alternately dilated and contracted, in such a way as to produce the appearance of a number of hollow beads connected by a tube. *Sacculated dilatation* consists in the development of patches which may be formed by a lateral protrusion of the bronchial wall, or may involve the whole circumference of the tube. A bronchus may exhibit one or more such dilatations. The neighboring *pulmonary tissue* is generally affected by chronic interstitial inflammation, causing induration and dark discoloration of the pulmonary connective tissue. The dimensions of the dilated spaces vary greatly from almost imperceptible enlargement of the bronchus up to a cavity equalling the size of a hen's egg, or even larger. The bronchi that communicate with such dilated spaces sometimes become occluded, giving origin to an isolated cavity filled with a fluid, which may become desiccated, or calcified.

The *mucous membrane* within the dilated portion of the bronchus generally indicates some degree of chronic inflammation. It may be somewhat thickened, or, especially in sacculated bronchiectasis, unusually thin and pale, resembling the appearance of a serous membrane. In some cases the membrane exhibits a transversly wrinkled appearance that is caused by local atrophy of the connective tissue and muscular

of the mucous membrane, leaving the elastic tissues in the form of rominent network. Occasionally the mucous membrane becomes rated, especially when the secretions have undergone putrefaction. s condition is liable to be followed by hemorrhage or by gangrene of adjacent lung tissue. Miliary tuberculosis, also, sometimes invades unhealthy mucous membrane that has undergone dilatation. The gs themselves are liable to chronic interstitial inflammation, or to umonic processes. Emphysema sometimes occurs, and catarrhal ammation may involve the bronchi and the alveolar passages. The ural surfaces frequently become adherent through the occurrence of esive inflammation. The right side of the heart may become ted, with the development of consequent obstruction of the circula-

ETIOLOGY. *Bronchiectasis* is always connected with previous chronic eases of the bronchi, lungs, or pleura. Capillary bronchitis, chronic nchitis, and bronchial constriction, frequently lead to this condition. s a disease that occurs more commonly at an advanced age of life, nen rather than women. The principal factor in the production of nchial dilatation is found in the increased pressure of the air into umscribed portions of the bronchial tree when, through the occurce of inflammation, or otherwise, considerable portions of the bronchi l of the pulmonary tissue have become impermeable. A yielding dition of the bronchial wall may be also produced by similar causes t have prevented the entrance of air into the obstructed portions of lungs. Dilatation, therefore, follows in the same way and under ilar conditions as in the analogous case of aneurismal formation ecting the arterial structures.

SYMPTOMS. In many cases the symptoms of bronchial dilatation fer in no way from the symptoms of chronic catarrhal bronchitis. onchiectasis may be suspected when occasional *paroxysms* of *cough* ld an *excessive amount* of *expectoration*. The patient may be able sleep all night without disturbance, but, on rising in the morning, is zed with a violent attack of coughing and, sometimes, of vomiting, companied by an immense discharge of sputa which have accumulated ring the night. So long as the contents of a dilated bronchus do not erflow into the bifurcation of the trachea, the reflex irritation by ich the cough is excited does not occur. The amount of the disarge sometimes reaches a full quart in the course of a day, even ough the general appearance of the patient does not seem to indicate very urgent disease. The sputa contain round cells in all stages degeneration, associated, sometimes, with more or less degenerated blood-corpulscles and hæmatoidin crystals. Sometimes the sputa sent a nummular form like that of the masses which are ejected from ercular cavities, but they generally present a more irregular surface, l sink in water.

On *inspection*, the lateral and posterior portions of the thorax somees appear to be retracted. This is especially true of chronic cases ociated with pleuritic adhesions or with interstitial inflammation of pulmonary connective tissue. Inspiratory retraction is not unfrently associated with this condition, in consequence of the inability

of the lung to follow the outward movement of the thoracic wall. The attitude of the patient may suggest the locality of the bronchial dilatation, since he endeavors as far as possible by his position to avoid irritation of the bronchial bifurcation with the contents of the enlarged bronchus. For this reason he generally seeks a recumbent position upon the diseased side. If dilatation have occurred in the upper portion of the lung, the constant outflow of the secretions keeps up a continual cough.

Palpation gives different results in accordance with the amount of liquid that is contained in a bronchial cavity. After its evacuation fremitus is increased, but it again disappears when the cavity is once more filled with mucus.

On *percussion*, the sounds that indicate the existence of the cavity are only clearly perceptible when the cavity is empty and is located near the thoracic wall. The characteristic tympanitic and metallic resonance is rarely obtained unless the dilated portion of the bronchus be at least three inches in diameter. The tympanitic sound is correspondingly muffled when the cavity is surrounded by lung tissue that is deprived of air.

If the dilated bronchial cavity communicates freely with the trachea, percussion will yield a *higher-pitched sound when the mouth is open* than when it is closed; and, as may be observed under similar conditions in connection with tubercular cavities in the lungs, percussion when the mouth is open occasions a peculiar modification of tympanitic resonance called the *cracked-pot sound*, from its resemblance to the characteristic note that is evoked by tapping upon the surface of a cracked pitcher or jar.

In this connection it must be remembered that the tympanitic sound on percussion over the cavity, is produced by the vibrations of its walls which are excited by the blow. A *sharp* and *metallic quality* indicates a *high degree* of *tension* in the vibrating membrane; hence the metallic resonance of smooth-walled, inflated cavities, in contrast with the duller note that is yielded by thick and flabby membranes. The higher pitch that is remarked when percussion is performed with the mouth open, and its reduction when the mouth is closed, are the results of changes which are thus effected in the length of the vibrating column of air. This is obviously longer when the mouth is closed than when it is open, for, in the first place, it extends from the cavity, through the communicating bronchus, trachea, larynx, pharynx, and nasal passages as far as the nostrils, while, in the second place, it is terminated, practically, at the entrance of the glottis. These changes of pitch and of quality depend upon the same changes of condition by which corresponding differences are effected in the case of musical instruments, *e. g.*, the flute, whose varying notes are produced by changes in the length of the vibrating column of air as the finger-stops are opened or closed. In like manner the *different pitch* and *quality* of *sounds* that, on percussion, are respectively yielded by *large* and by *small cavities*, are dependent upon conditions quite comparable to those which constitute the differences between the sound of a bass drum and that of a snare drum.

Auscultation indicates similar variations in the quality of the respira-

ds that accompany a bronchial dilatation. They are present
cavity is empty, and disappear when it becomes filled with
he râles which accompany accumulation of fluid in the bronchi
uality and in quantity according to the amount of exudation.
associated with vesicular sounds when air finds access into the
pulmonary cells. The sound of the voice becomes more audi-
acquires a metallic resonance, when heard over a large and
l cavity that is distended with air; as it becomes filled with
etion, bronchial sounds disappear.

g as the consequences of bronchial dilatation are restricted to
ed locality, the general health may be not seriously disturbed.
urulent absorption take place, a febrile movement occurs, and
me a *hectic character*, and *life may be terminated* by *exhaus-*
diarrhœa. The limbs often become œdematous before death,
lt either of general innutrition, or of dilatation and failure of
side of the heart, producing consequent obstruction of the cir-

Sometimes death occurs as a consequence of putrid bronchitis
equent gangrene of the lungs. It must be remembered, how-
t the existence of putrid sputa does not necessarily indicate
ence of bronchiectasis, for it may be the result of chronic
s alone. Among other complications and sequelæ of bronchial
may be enumerated *hæmoptysis*, as a consequence of ulcer-
he bronchial mucous membrane; *pyo-pneumothorax*, which may
ced by the rupture of the bronchial cavity into the pleural sac;
ry emphysema; inflammation of the *lungs; inflammations* of
s, probably caused by purulent absorption; *cerebral abscess;*
is; suppuration within the spinal cord; tuberculosis; and
degeneration of the *abdominal organs*.

NOSIS. Bronchiectasis may be easily recognized when the
ristic expectoration appears in association with the symptoms
istence of a cavity. From *tuberculous cavities* within the lungs
e distinguished by the history of the case, by the locality of
ed bronchus in the lower or middle lobe rather than in the
the lungs, and by the absence of tubercle-bacilli in the sputa.
the contents of an *encysted pyo-pneumothorax* that is discharged
the lungs, the expectoration in bronchiectasis may be distin-
by the absence of the odor of sulphuretted hydrogen in the
es, and by the absence of cholesterine and hæmatoidin. *Pul-*
gangrene may be distinguished from putrid bronchitis affecting
l bronchus, by the presence of broken-down lung tissue in the
ous expectoration.

NOSIS. The prognosis is very unfavorable, by reason of the
s complications and sequelæ to which the disease is liable.

TMENT. Three principal objects must be kept in view in the
t of bronchiectasis: 1. The dilated bronchus must be emptied
s of expectorants or emetics (p. 444). 2. Diminution of secre-
st be attempted by the inhalation of sprays impregnated with
rpentine or carbolic acid (2 per cent.). Astringents have been
ly employed, but with very little result. 3. Disinfection of
ents of dilated bronchial cavities must be effected by the inha-

lation of spray that is medicated with antiseptics, such as carbolic acid solutions of salicylic acid, thymol, resorcin, boric acid, and Listerine.

A nutritious diet and careful attention to hygienic proprieties are indispensable.

The surgical treatment of bronchiectasis by incision and drainage has been attended with very little encouragement. The majority of cases are either not benefited, or are made worse by such interference.

Bronchial Constriction—Broncho-stenosis.

PATHOLOGICAL ANATOMY. The *bronchi* may be *constricted* by the accidental *intrusion* of *foreign bodies*, or by *inflammatory exudation* within the *thoracic cavity*, or into the *tissues* of the *bronchial wall*, as a consequence of syphilis or glanders, or as a sequel of the discharge of a glandular abscess into the bronchial tube. The neighborhood of a tumor or other enlargement involving any of the organs within the thorax may produce compression and stenosis of one or more bronchi.

SYMPTOMS. *Bronchial stenosis* occurs in its most characteristic form when a bronchus has been partially occluded by the accidentral intrusion of a foreign body. Any considerable obstruction of the principal bronchus, on either side of the thorax, is followed by *diminished respiratory movements* upon the affected side, and by the symptoms of *dyspnœa—e. g.*, prolonged inspiration, inspiratory retraction of the intercostal spaces and lower portion of the thoracic wall, etc. With the reduction in the frequency of respiration *local fremitus* is diminished, or completely abolished, upon the affected side, because the laryngeal vibrations can no longer be propagated to the pulmonary periphery. *Percussion sounds* remain unchanged, unless the air ceases to occupy the pulmonary cells. *Pulmonary collapse* is indicated by dulness on percussion. *Auscultation* discovers a more or less complete disappearance of the vesicular murmur of inspiration, since the air cells receive little or no air during that act. The locality of the constriction is indicated by various *râles* which are sometimes audible at a distance from the patient. *Bronchophony* ceases throughout the affected region.

There is great complaint of anxiety and suffocation; the *voice* frequently becomes hoarse and weak; there may, or may not, be *cough* and *expectoration;* the *pulse* may be either abnormally retarded or accelerated. In like manner *febrile symptoms* sometimes may be either present or absent.

If only a smaller bronchial passage be obstructed, the extent and severity of the symptoms are correspondingly reduced. *Fatal cases* are terminated either by the development of *asphyxia* or by the occurrence of *inflammatory conditions* in the *lungs*, producing pulmonary œdema, or simple inflammation, or abscess, or gangrene. *Death* may also result from the causes which have produced bronchial stenosis.

DIAGNOSIS. Bilateral stenosis may be distinguished from *tracheal* or *laryngeal constrictions* by the aid of the laryngoscope. The locality of a unilateral stenosis may generally be identified by auscultation. The auscultatory sounds are most conspicuous at the point of constriction.

cause of the obstruction, when intrusion of foreign bodies is ex-
led, must be determined by the history of the patient, and by inves-
tion of the organs which lie in the vicinity of the bronchi.

PROGNOSIS. The prognosis is almost always unfavorable, though
haps less so in cases of syphilitic origin. Foreign bodies sometimes
removed accidentally through the acts of coughing, laughing, sneez-
g, or vomiting, even after they have been lodged for years in the air-
ssages.

TREATMENT. The treatment must be adapted to each case in accord-
ce with general principles. Foreign bodies may sometimes be removed
inverting the patient, or by the administration of emetics, or by
cheotomy and the introduction of forceps into the bronchi. Syphi-
ic cases require a specific treatment with mercurials and iodide of
tassium. Dyspnœa without pronounced symptoms of asphyxia may
relieved by the cautious use of opiates.

Bronchial Asthma.

SYMPTOMS. *Bronchial asthma* is characterized by the occurrence
paroxysms of *dyspnœa* which have their origin in a spasmodic con-
ion of the muscles. During the interval between successive paroxysms
patient may enjoy excellent health.

An *asthmatic attack* may be ushered in without warning, or it may
preceded by symptoms of depression, disordered digestion, gaseous
tention of the stomach and bowels, and other symptoms which indi-
te the existence of slight and transient catarrhal inflammation of the
stro-pulmonary mucous membranes. Female patients sometimes ex-
rience a recurrence of asthma in connection with the menstrual
och. Many patients suffer from a recurrence of a paroxysm on the
ghtest provocation—such as a change of sleeping-rooms, even in the
me house. Other patients experience a similar result after indulgence
certain articles of food or drink. Sometimes the occurrence of the
roxysms occurs with such regularity as to suggest their dependence
on malarial infection.

The asthmatic paroxysm frequently occurs during the middle of the
ght; the patient is awakened out of deep sleep, and starts up out of
d, driven by the impossibility of breathing to the nearest window,
hich is thrown open, leaning far out and pressing his chest against
e window-sill in the eagerness of his efforts to obtain fresh air. If
nable to leave the bed, he finds himself compelled to remain in a
tting posture, or to lean forward with his hands placed upon the
arest support. The skin is cool, the pulse is accelerated, small, and
nse. Inspiration is slow and laborious, while expiration is still more
fficult and prolonged. The countenance expresses the horrible dis-
ss which the patient experiences; the veins become prominent, the
s and the surface of the body exhibit an increasing cyanosis, perspi-
tion covers the skin with cold and clammy sweat, the accessory mus-
s of respiration are called into a high state of activity by the con-
ction of the abdominal muscles; the inferior portions of the thorax
drawn downward during inspiration, the recti muscles project like

solid bars of wood, involuntary evacuations of urine and feces sometimes occur. If the attack be considerably prolonged, symptoms of venous congestion involve the brain, and there may be indications of delirium, or of a tendency to convulsive movements in the muscles of the extremities. Auscultation discovers, throughout the whole extent of the lungs, numerous râles and rhonchi, which are especially noisy during the act of expiration, so that the entire cavity of the thorax is literally converted into a "chest full of whistles." Vesicular breathing is either absent or rendered inaudible by the noisy râles that accompany respiratory movements. Percussion indicates no loss of resonance; in fact, the thoracic cavity becomes more resonant, and emits a deeper tone than under normal conditions. The limits of pulmonary resonance extend downward from one to three intercostal spaces lower than usual, and the area of cardiac dulness is diminished by the inflation of the anterior border of the left lung. The heart sounds are, also, less audible for the same reason.

As the paroxysm subsides, the bronchial râles become moist and less noisy. Dyspnœa and other urgent symptoms subside, and the attack usually terminates with a moderate amount of expectoration.

Microscopical investigation of the sputa indicates the presence of minute spiral filaments which appear to be derived from exudation into the smaller bronchial passages. Associated with these filaments are various epithelial cells that have been exfoliated from the mucous membrane of the bronchi, and numerous round cells which exhibit various stages of degeneration. With this débris occur numerous acicular crystals, the so-called asthma crystals, regarding the nature and origin of which there has been much discussion without very positive results.

As to the *nature* of the *asthmatic process*, it is apparent that it consists in an irritation of the nervous system, involving chiefly the terminal fibrils of the pneumogastric nerve, by which spasmodic contraction of the bronchial muscle is effected. This may exist as a reflex consequence of disordered conditions in distant organs, or it may be the direct result of temporary excitement of the nerve itself. The occurrence of catarrhal disorders in persons who are predisposed to asthma, operates as a means of increasing the previous excitability of the nervous apparatus. The undoubted relation that exists between asthmatic attacks and other nervous disorders, and their alternation with paroxysms of nervous disturbance, such as angina pectoris or hemicrania, argue in favor of the neurotic character of the disease.

Etiology. *Two forms* of *bronchial asthma* have existence. The *first* is dependent upon diseases of the central nervous system; while the *second* is the result of reflex excitation of the pneumogastric nerve. With regard to the first form, considerable doubt may be connected with the theory that asthma is the direct result of cerebral disease; what is more certain is that direct disturbances of the pneumogastric nerve are not unfrequently followed by asthmatic paroxysms. In this way the existence of tumors by which the nerve is compressed in the neck, or in the thorax, operate powerfully, in many instances, to excite the disease. Only when these directly impinge upon the trunk or upon the branches of the nerve can they be considered as direct causes of asthma.

e frequent are the cases in which irritation arising from disease in ınt organs is propagated to the central origin of the pneumogastric, is thence communicated to the muscles in the bronchial wall. In way the existence of irritation in the nasal mucous membrane, such ccurs in hay fever, and after inhalation of ipecacuanha powder, or lred substances, may produce an asthmatic paroxysm. Diseases of nasal mucous membrane, such as polypi, adenoid growths, chronic ıefaction of the turbinated processes; chronic pharyngitis; enlarge- nt of the tonsils; diseases of the heart; dyspeptic conditions, chronic ammations of the digestive organs, constipation, and the presence of rms in the intestines; diseases of the ovaries and of the uterus; the te of pregnancy; and chronic nephritis, may any one of them prove icient excitants of reflex asthma.

Besides these forms, and, probably, in many cases connected with em, are cases of asthma that are undoubtedly dependent upon *intoxi- tion* of the *blood* with various poisonous substances. Such are many ses of asthmatic paroxysm which occur in the course of chronic renal sease, or as a consequence of gout or rheumatism. Lead and mer- rial poisoning are also sometimes causes of toxic asthma. The sease occurs most frequently between the twentieth and fortieth years life, though children and old people sometimes suffer with it. More equently it is observed among men than among women. Delicate d unhealthy people, especially those of rachitic or tubercular predis- sition, are particularly inclined to the disease. Those forms which pend upon catarrhal conditions of the bronchial membranes are more kely to occur during unfavorable seasons of the year, and in cold mp localities.

Pathological Anatomy. Since the disease, so far as the bronchi e concerned, is a functional disorder, pathological changes are not nspicuous, unless bronchial catarrh may exist as a complication. econdary changes may follow repeated attacks, producing emphysema nd atelectasis of the lungs.

Diagnosis. The recognition of bronchial asthma seldom presents ny difficulty, since no other disease is characterized by paroxysms of xpiratory dyspnœa accompanied by excessive inflation of the pul- onary air cells. Other forms of dyspnœa are characterized by inspi- atory obstruction of the respiration, or by a simple feeling of breath- ssness without any evident local cause in the respiratory organs.

Prognosis. Despite the alarming appearance of the patient during paroxysm of asthma, the prognosis is not unfavorable. Death very rely occurs during an attack, since any considerable accumulation of rbonic acid in the blood and in the tissues necessarily produces re- xation of the muscular spasm by which the bronchioles are occluded; nd, thus, air immediately finds access to the alveolar passages, with rompt relief of dyspnœa. When the disease occurs among young ildren they usually recover permanently as they grow up.

Treatment. The treatment of the asthmatic paroxysm, if depen- nt upon acute indigestion, should be commenced by the administration a prompt emetic (apomorphine $\frac{1}{10}$ of a grain hypodermically). After e stomach has been evacuated, or, as the first step in the treatment, if

gastric embarrassment do not exist, thirty grains of chloral hydrate should be given in a wineglassful of water. This dose may be repeated within half an hour, if sufficient relief be not already procured. A hypodermic injection of morphine and atropine should also accompany the first dose In this way the paroxysm will generally be conducted to a speedy termination. The use of other narcotics and emetics gives less satisfactory results. When reflex irritation proceeds from the naso-pharyngeal mucous membrane, a favorable result may be obtained by pencilling the parts with a ten per cent. solution of cocaine. Inhalations of chloroform, nitrite of amyl, ether, and other similar substances have been practised with more or less success. Lately, French authors recommend inhalations of pyridine, of which a teaspoonful may be poured into a saucer and held before the face. German authors, of course, look with special interest upon the failures which follow this method of treatment.

Inhalation of medicated fumes from burning paper that has been dipped in solutions of arsenic and saltpetre, and the use of powders containing saltpetre and dry stramonium leaves, and burned in a large container so as to create a dense smoke, oftentimes affords considerable relief. The ordinary pastiles are too small to produce much benefit. Some persons derive great relief from simple measures, like the smoking of a cigar, or the sucking of ice, or the use of peppermint drops, or common nervous stimulants. Many other remedies have their advocates, but none compare with those which been have first indicated.

For the prevention of the paroxysm, the constitutional predisposition of the patient, and the present state of his health, should be carefully studied. Local diseases must be cured, if possible; gastro-intestinal disorders must be guarded against; gout and rheumatism must be suppressed; malarial poisoning and other infective conditions must be obviated. Excellent effects are often obtained from the long-continued use of iodide of potassium (five to ten grains three times a day). This drug is the basis of the majority of the proprietary remedies for asthma that possess any special value. The inhalation of a one per cent. solution of common salt, repeated several times a day, is recommended for the solution of asthma crystals. The use of electricity, by the method of central galvanization, is of some service in cases that are complicated by nervous predisposition. Sometimes it happens that nothing will insure a patient against recurrent paroxysms excepting removal from the locality in which he has resided. Favorable effects may be thus obtained by a change of residence to the mountainous regions in the central portions of the continent. During the winter months it is desirable to seek a dry, warm, and sunny locality, such as may be found in many parts of Texas, Southern California, and Mexico. In every case particular attention must be directed to the clothing, diet, and habits of the patient.

Inflammation of the Tracheo-bronchial Lymph Glands.

The *lymph glands* which are connected with the air passages are subject to acute inflammation and enlargement as a consequence of

ammation involving those air passages. Chronic inflammation, hilis, leukæmia, and pseudoleukæmia are sometimes attended with siderable swelling of the lymph glands, which may then exercise leterious pressure upon the neighboring bronchi, or upon the œsopha- s and the pneumogastric nerves. The degree of tumefaction may metimes be so great as to produce a notable dulness on percussion er the upper portion of the sternum. The degree of compression erted upon neighboring organs may interfere considerably with spiration, and may excite a most harassing cough, or vomiting. The ovement of the heart may be disturbed, and symptoms of obstructed rculation may become apparent. The subsidence of such swelling is self sometimes the cause of additional disturbances in the neighboring rgans, as may be observed when an enlarged gland has become dherent to the wall of the œsophagus. During the subsequent con- raction that accompanies the reduction of the glandular swelling, the sophageal wall is at that point drawn outward, and a pouch or iverticulum is formed. Glandular tuberculosis sometimes leads to uppuration, with subsequent evacuation of pus into neighboring cavities r vessels. In this way sudden asphyxia may be produced by the upture of the abscess into the trachea or into a large bronchus. If upture does not follow the process of suppuration, the imprisoned pus ay become caseated, or, finally, calcified.

Malignant diseases of the *glands* are attended with even more exten- ive enlargement, and with corresponding symptoms of pressure and ncroachment upon neighboring organs.

CHAPTER V.

DISEASES OF THE LUNGS.

Pulmonary Hemorrhage—Hæmoptysis.

ETIOLOGY. *Hæmoptysis* signifies the presence of blood in the puta of expectoration. This may proceed from many causes, hence he spitting of blood is to be regarded as a mere symptom, and not as disease. Blood may thus be discharged from the larynx, from the rachea, the bronchi, or the parenchyma of the lungs; but, since emorrhage from the larger air passages is a rare event, it may be fely assumed that in the majority of cases hæmoptysis is the result inflammatory or ulcerative processes in the bronchi or pulmonary bstance.

Bronchial hemorrhage may tinge the sputa with streaks of blood in es of severe bronchitis. It also occurs in connection with the forma- n of casts in the bronchi. Valvular diseases of the heart that are nded with obstruction of the circulation through the lungs may asion an oozing of blood from the bronchial mucous membrane. e same event may be observed as a consequence of bronchiectasis, or

of putrid bronchitis, when the mucous membrane has been eroded and the bloodvessels are laid bare.

Violent bodily exertion which necessitates inordinate action on the part of the respiratory organs; their irritation by the inhalation of irritating gases, *e. g.*, chlorine, ammonia, excessively hot or cold air, etc., and the intrusion of foreign bodies, are not uncommon causes of hæmoptysis.

The occurrence of pulmonary consumption is sometimes attended by hemorrhage from the bronchial vessels as a consequence of degenerative changes that are dependent upon the tubercular process. In this way hæmoptysis may become one of the earliest symptoms of pulmonary tuberculosis, before any physical signs can be discovered in the lungs.

In like manner bronchial hemorrhage may result from the various infective diseases in which a tendency to hemorrhage is manifested. Renal and hepatic diseases by which the blood is overcharged with refuse matter, and certain dyscrasiæ, such as scurvy, hæmophilia, and purpura, may be accompanied by bronchial hæmoptysis. The suppression of customary discharges of blood from other organs, such as may occur in persons who are liable to epistaxis, bleeding piles, or profuse menstruation, may lead to the occurrence of a species of vicarious hemorrhage from the bronchial mucous membrane.

Similar hemorrhage may be due to the reduction of atmospheric pressure that occurs during balloon ascensions or mountain climbing.

Hemorrhage from the *parenchyma* of the *lungs* may result from actual rupture of the bloodvessels, or from the passage of red blood-corpuscles through the capillary walls. It occurs, most frequently, during the course of pulmonary consumption; in the earlier stages of the disease it generally assumes the character of a capillary oozing, but during the later course of the disease, after the formation of cavities, it may result from the rupture of arteries that have been thus exposed.

Abscess and gangrene of the lungs may also occasion an erosion of the walls of arteries that have been reached by the process, with consequent escape of blood in the form of a copious hemorrhage. In like manner tumors and parasites in the lungs (Distomum Ringeri, Filaria, Gregarina pulmonalis, and Echinococcus) may become causes of hemorrhage.

Acute inflammation of the lungs is attended with hæmoptysis by which the sputa acquire their characteristic color. The rupture of an aneurism into the lungs will of course be followed by abundant hemorrhage. Heart diseases frequently cause embolic processes in the lungs, with formation of infarcts and hemorrhages in those organs. Sometimes the intruded embolus can be discovered, but in certain cases hemorrhage seems to be the result of capillary degeneration rather than of obstruction. Actual obstruction is frequently dependent upon a disease of the mitral valve, with dilatation of the right side of the heart, and the formation of thrombi in its cavities. Obviously, however, similar results may follow the formation of thrombi in any of the veins that communicate more or less directly with the right auricle.

ervous diseases and disorders are sometimes accompanied by hæmo-
is; this is notably the case among hysterical patients.
læmoptysis occurs most frequently during the twenty years that
w the age of puberty; that is, during the period when pulmonary
rculosis is most frequently observed.
ATHOLOGICAL ANATOMY. *Bronchial hemorrhage* is accompanied
swollen, reddened, and congested appearance of the mucous mem-
ie. It is not easy to discover any definite point of escape through
h the blood enters the bronchi, since the hemorrhage generally con-
of a capillary oozing. Sometimes the mucous membranes are pale,
consequence of collapse after excessive hemorrhage. The air cells
frequently filled with blood, and blood corpuscles may be traced in
r course through the epithelial lining of the cells into the inter-
al connective tissue.
When hemorrhage takes place into the pulmonary parenchyma, there
be excessive accumulation of blood and broken-down lung tissue,
stituting what is termed *pulmonary apoplexy*. When hemorrhage
es place through the walls of a cavity, the point of rupture may be
quently discovered in the wall of an exposed artery. The arrest of
morrhage under such circumstances is effected by the formation of a
ombus by which the vessel is occluded. When capillary hemorrhage
urs into the substance of the lung, it is not always easy to discover
ere the blood made its escape; a dark-red mass remains surrounded
inflated and emphysematous air cells. This is the *hemorrhagic in-*
ct. After a time such blood corpuscles as have not been removed
absorption become disintegrated, and their pigmentary detritus re-
ins in the alveolar and interfundibular septa. Hemorrhagic infarcts
at are produced by emboli or thrombi derived from the heart, may be
cognized by their conical form, of which the broad base is directed
ward the periphery of the lung, while the point is directed toward
roots. In the majority of cases the process of infarction occurs in
lower lobe of the right lung, which receives blood most readily from
right ventricle. Under ordinary circumstances embolic infarcts are
orbed, leaving behind a dark pigmented mass of indurated connec-
tissue; but if an infective embolus or thrombus finds its way into
lungs it may originate inflammation, suppuration, or even gangrene.
SYMPTOMS. A small amount of blood may find its way into the air
ages without exciting notable symptoms, or *death* may occur from
den *asphyxia* in connection with copious hemorrhage before blood
appear externally; but, generally, the occurrence of hæmoptysis is
rved among patients who are already the victims of *pulmonary* or
diac disease.
t often happens that before the appearance of blood in the sputa
e is complaint of a peculiar, salty taste in the mouth, or a sensa-
of heat and upward pressure along the course of one of the larger
nchi or the trachea. Sometimes the sputa are but slightly discolored
h blood; in other cases the mass consists of bright-crimson blood,
ed with frothy mucus. In still other cases it may gush out of the
uth and nose as if an artery had been severed. If any considerable
tion be swallowed, vomiting is often excited, and the patient both

spits and vomits blood. The quantity thus evacuated is sometimes sufficient to produce death in a very short space of time, either as a result of asphyxia or as the direct consequence of hemorrhage (acute anæmia).

Sometimes hæmoptysis is characterized by only a single discharge; in other cases it recurs at short intervals for several days. When dependent upon malarial infection, the recurrence is periodical unless arrested by large doses of quinine.

The color of the *sputa* varies with the amount of blood and the length of time since its evacuation from the bloodvessels. Bloody sputa are generally frothy, and of a bright-scarlet color; but if blood has been retained for any length of time in a cavity, it becomes coagulated and exhibits a dark color, hence after copious hæmoptysis it is not uncommon to witness the occasional discharge of dark clots which are coughed up for two or three days after the original hemorrhage. Hæmoptysis that accompanies pneumonic inflammation, or gangrene, or hemorrhagic infarction, often presents a rusty color like that of tobacco-juice or prune-juice. In chronic inflammation like that which characterizes putrid bronchitis, when the quantity of blood is scanty, and when the blood corpuscles have undergone considerable disintegration, the color of the sputa resembles that of clay or mud.

Slight hæmoptysis produces no physical signs of change within the thorax. If the air cells are filled with blood, *fine râles* may become audible; and, if any considerable territory is thus obstructed, *dulness on percussion* may be perceived, with other *symptoms* of *pulmonary consolidation.*

A *febrile movement* is sometimes observed during the absorption of blood that has been poured out of the capillaries into the air passages and air cells, especially if associated with chronic inflammatory conditions and putrefaction within the respiratory organs. *Acute inflammation* is sometimes excited by hemorrhagic processes; and in this the pleural surfaces that cover a hemorrhagic infarct are very liable to share.

DIAGNOSIS. *Hæmoptysis* must be distinguished from *pharyngeal* or *laryngeal hemorrhage*, and from *bleeding within the cavity of the mouth.* Careful investigation of these cavities will facilitate diagnosis. Hæmoptysis must also be distinguished from *hæmatemesis.* Hemorrhage from the stomach is consequent upon diseases of that organ which are attended with ulceration. Blood from such a source is usually coagulated, dark in color, and possesses an acid reaction as a consequence of the presence of gastric juice. Gastric hemorrhage is also frequently followed by black and tarry stools consisting largely of altered blood. Hæmoptysis is usually preceded by diseases of the heart or lungs. The blood that is ejected is bright and frothy, with an alkaline reaction; if dark and clotted, it is owing to a prolonged sojourn in the bronchi or in the pulmonary cavities. Only when previously swallowed, will it be thrown up by the act of vomiting. In like manner dark, clotted blood, with an acid reaction, that has been vomited from the stomach, may sometimes find its way into the larynx and trachea, and be subsequently ejected by the act of coughing. Blood from the nasal

aural cavities may, in a similar manner, find its way into the air ages or into the stomach, and create temporary confusion in the er of diagnosis, but careful observation and consideration of the ious history should soon remove all obscurity regarding the nature he hemorrhage. *Microscopical observation of the sputa*, and the overy of tubercle bacilli, or the appearance of parasitic structures, sometimes serve to explain certain difficult cases. Physical exam- ion of the chest will, of course, demonstrate the presence of morbid ducts within the pulmonary organs.

ROGNOSIS. The prognosis is not necessarily unfavorable, for slight s of hæmoptysis are often followed by complete and permanent re- ry. Copious hemorrhage may sometimes terminate life suddenly; as a rule, the appearance of blood is merely a symptom of some r disease, upon which the prognosis will chiefly depend.

REATMENT. Prophylactic treatment is based upon a recognition of predisposing causes of hemorrhage, and upon the avoidance of such osure to cold or violent exertion as may occasion hæmoptysis. ere cough may be moderated by the use of narcotic remedies (p.); diseases of the heart require the cautious use of digitalis. The rrence of peripheral diseases associated with the formation of mbi, *e. g.*, femoral phlebitis, requires perfect rest and the avoidance nanipulations or movements by which thrombotic fragments may be oduced into the course of the circulation.

For the arrest of actual hæmoptysis, the patient must be placed etly in bed, with as little disturbance as possible in the way of physical mination and movement of the body. Food should be restricted to l liquids; ice, and ice-water, may be given as desired. Fifteen ims of the fluid extract of ergot should be injected hypodermically ce or three times a day. If the air passages be obstructed with blood s to cause danger from asphyxia, expectorant mixtures, or stimulant etics, may be administered. Astringents and saline remedies are en very efficacious; a teaspoonful of common salt or of saltpetre will metimes be sufficient to arrest a moderate hemorrhage. Lead and um pills, tannic acid, gallic acid, the perchloride of iron, etc., have been used with advantage. Pulverization of the same substances, a two or five per cent. solution, is often employed for purposes of alation, but this method is sometimes followed by inflammation of lungs. The stimulant effect of balsamic remedies sometimes pro- es a favorable result.

℞.—Tr. benzoin. co. ℳxxx.

S.—On sugar, every half-hour.

℞.—Balsam. copaib.
Syr. picis liquid. } āā ℥ij.
Alcohol.
Spt. æther. nitros. ℥jss.
Aq. menth. pip. ℥iv.—M.

S.—A tablespoonful twice a day.

The mineral acids (ten drops in four ounces of water every two hours) frequently useful; of these, aromatic sulphuric acid should be pre-

ferred. The patient must be cautioned to suck the liquid through a glass tube, and to rinse the mouth with cold water, in order to prevent the effects of the acid upon the teeth.

External counter-irritation with dry cups, sinapisms, and irritating liniments, is often of great service; sometimes the application of cloths wrung out of hot water produces a better effect than can be obtained from the ordinary method of applying ice-bags to the thoracic wall.

Plethoric patients may be benefited by venesection, or by the application of leeches. Hæmoptysis that is dependent upon suppression of the menses or of hæmorrhoidal discharges, may be promptly arrested by the application of a half-dozen leeches to the anus, or to the inside of the thighs just above the internal condyles.

A very useful method in many cases consists in the application of ligatures or tourniquets about the limbs near their juncture with the body, by which sufficient pressure may be exerted to retain a considerable quantity of blood in the vessels of the extremities without completely arresting the circulation. In this way the degree of blood pressure within the pulmonary vessels can be considerably diminished. The operation may be continued without risk for an hour, and should be repeated as often as beneficial.

Alveolar Emphysema—Emphysema Pulmonum Alveolare.

Pathological Anatomy. *Dilatation of the air cells of the lungs* may occur for a short time without the production of emphysema, but its frequent repetition or its long persistence leads to a permanent expansion of the infundibular and alveolar spaces, with atrophy of their septa. These changes may be limited to a small portion of the lungs; they may be unilateral or bilateral, and may occupy an extensive portion of the lungs. The affected portions appear pale, bloodless, and dry; and they crepitate on pressure between the fingers. The *enlarged air cells* are distinctly visible, and sometimes reach great size through the absorption of intervening septa The anterior surfaces and the median border of the lungs, especially in the upper lobes, exhibit the highest degree of alveolar dilatation. The *thorax* is round and distended; the *lungs* remain expanded when the chest is opened; *pleuritic adhesions* are not uncommon; there is *catarrhal inflammation in the smaller bronchi;* the *heart* is concealed from view by the overlapping borders of the emphysematous lungs, and its right side is often considerably dilated and filled with blood; the *venæ cavæ* are also distended; the *diaphragm* is depressed by the voluminous lungs; the *liver* exhibits evidences of venous hyperæmia and enlargement if death has taken place at a comparatively early period, or of contraction if life has been sufficiently prolonged; the *spleen* is somewhat enlarged, and shows hypertrophy of its connective tissue; the *gastro-intestinal mucous membrane* is swelled and slightly inflamed; the *hæmorrhoidal veins* are frequently dilated; the *kidneys* also share in the universal venous distention that follows dilatation of the right side of the heart.

ETIOLOGY. *Pulmonary emphysema* is generally encountered in anced life, more frequently among men than among women. mate and weather that favor the occurrence of cough are predis- ing causes of the disease.

The most common cause of emphysema is found in *disorder of the piratory organs.* Chronic catarrh of the smaller bronchi is the usual iting cause, but any other condition by which the bronchi may be stricted can lead to the development of alveolar emphysema. Under h circumstances all movements that necessitate extraordinary effort the part of the respiratory organs become active agents in the tation of the air cells.

Emphysema of the lungs that is produced by the foregoing causes is med *substantial emphysema.* Besides this form of the disease a iety may exist that is developed as a consequence of more or less plete occlusion of certain portions of the lungs, so that adjacent tions which still receive air are subjected to an inordinate degree of ansion. This form of the disease is termed *vicarious emphysema,* l it occurs in connection with effusion into the pleural cavities, ex- sive dilatation of the heart, thoracic aneurisms, tumors, etc. Two ms of emphysema may sometimes occur in the same pair of lungs, ce one does not exclude the other.

SYMPTOMS. The loss of elasticity that is experienced by the pul- nary tissue as a consequence of atrophy and dilatation of the walls the air cells, diminishes the respiratory power of the lungs, pro- cing what is termed *expiratory insufficiency.* The degree of this ufficiency may be readily estimated by the aid of a pneumatometer. e ventilation of the lungs will be proportionately hindered, and thus ll be created a corresponding sensation of the want of air.

The dilatation and atrophy of the alveolar walls occasion a consider- le reduction in the number of the capillary vessels and of the surface ailable for aëration of the blood; hence another cause for the sensa- n of want of air.

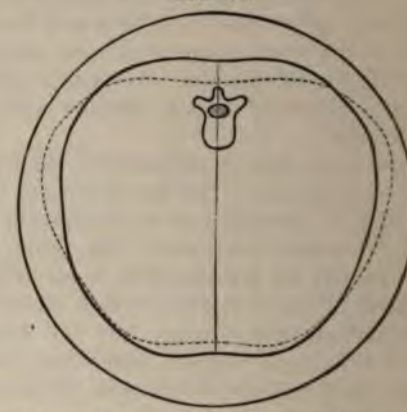
Reduction in the number of capillary vessels that are available for e pulmonary circulation produces increased pressure in the pulmonary tery; consequently, the right side of the heart must become dilated d hypertrophied, if the pulmonary circulation is to be maintained. however, the cardiac muscle fails, the phenomena of obstructed cir- lation will immediately appear, and this condition will be inevitably llowed by its usual consequences and termination.

During the earlier period of the disease dyspnœa is only felt after usual exercise, or during the occurrence of bronchial catarrh, or enever a slight chronic catarrh is temporarily aggravated. Under h circumstances asthmatic paroxysms are not uncommon.

The physical signs of pulmonary emphysema become more con- cuous as the disease progresses. (Fig. 100.) *Inspection* indicates t the thorax has assumed a more cylindrical form, with an increase depth between the sternum and the spinal column. The intercostal ces are widened and slightly depressed. The supra-clavicular fossæ sometimes considerably prominent, and bulge outward in the act coughing. The movements of respiration are accelerated and

shallow, as if the thorax wall were always maintained in an inspiratory position. The auxiliary muscles of inspiration, notably those in the neck, become consequently hypertrophied. The large veins are distended, and the surface of the body exhibits a more or less cyanotic appearance.

FIG. 100.



Bilateral enlargement of emphysema. Inner line, emphysematous chest. Outer line, a circle drawn to show how nearly the emphysematous approaches the circular shape. Dotted line, natural adult chest. (GEE.)

Palpation yields a sensation of limited respiratory movement in the thoracic wall. Vocal fremitus is reduced, the cardiac impulse can be only very faintly or not at all perceived, on account of the imperfect conductive power of the emphysematous lung tissue that is intruded between the heart and the thoracic wall. Sometimes the hypertrophied right ventricle can be felt beneath the ensiform cartilage.

Percussion yields a note that is more resonant than normal, and indicates considerable depression of the diaphragm. The upper surface of the liver is found at the level of the eighth rib, or lower, instead of lying at the upper border of the seventh rib in the right mammary line. Cardiac dulness is greatly reduced, or entirely abolished. Posteriorly, the lower border of the lung is found on a line with the twelfth dorsal vertebra, and there is very little change in the level of the diaphragm during the movements of respiration. With the aid of a spirometer, considerable reduction of the vital capacity of the lungs may be demonstrated.

Auscultation reveals great, if not complete, loss of the vesicular murmur, the expiratory sound being prolonged and of low pitch. The heart sounds are also reduced in intensity and the diastolic pulmonary sound is accentuated by reason of increased pressure in the pulmonary artery. Systolic murmurs sometimes exist as an evidence of anæmia or of a degenerated condition of the cardiac muscle, or as a consequence of auriculo-ventricular valvular insufficiency, dependent upon cardiac dilatation.

Besides the vesicular sounds which are characteristic of alveolar emphysema there may be signs of intercurrent complications, such as

râles that indicate the presence of bronchial inflamma-

tion of the disease may be very tedious, sometimes continu-
ildhood to an advanced age. *Death* usually results from
ficiency that may be dependent either upon fatty degener-
on some unusual and excessive task that is laid upon an
burdened organ. The evidences of retarded circulation
and death follows. Sometimes the lungs become œdema-
bral hemorrhage may occur.
nally happens that during a violent fit of coughing, or some
f excessive exertion, a rupture of the emphysematous lung
lace, thus orignating a *pneumothorax*, if the air enter the
ty, or a general, *subcutaneous emphysema* if it escape into
al lung tissue. *Pulmonary inflammation*, or *embolic pro-*
dent upon cardiac disease, or *hemorrhage* in connection with
hial inflammation, may occur as complicating diseases.
that emphysema and pulmonary consumption or valvular
e heart are incompatible, is not without foundation, though
the general rule are not very uncommon.
s. A slight degree of emphysema may exist without
through the ordinary physical signs. The existence of
sufficiency and want of air, which cannot be accounted for
way, should lead to a suspicion of pulmonary emphysema.
atation of the air cells may be distinguished from emphy-
recent development of physical signs, and by their rapid
e when the cause is removed. *Pneumothorax* may be dis-
y its almost uniformly unilateral occurrence, and by the
nance of the sounds that are elicited by auscultation and
Congenital hypertrophy of the lungs, though exhibiting
vnward extension of pulmonary resonance, may be dis-
y the normal character of the respiratory movements.
S. So far as speedy death is concerned, the prognosis in
mphysema is not unfavorable; but the opposite is true in
permanent cure. Severe pulmonary or cardiac diseases add
e gravity of the situation.
NT. Prophylactic treatment necessitates the avoidance of
by which bronchial inflammation and pulmonary or cardiac
be either induced or aggravated. The treatment of such
f already existing, forms the most important part of the
and symptomatic treatment of emphysema.
results may theoretically be obtained through the methods
therapy, since expiratory insufficiency is relieved by expira-
essel that contains air under reduced pressure. By this
intra-vesicular air is, as it were, sucked out of the dilated
es. Conversely, the respiratory process is facilitated by the
f compressed air, which forces its way more readily through
d bronchioles into the air cells. Through a combination
methods—by inhaling air from a vessel in which it is sub-
creased pressure, and by exhaling into a partial vacuum—
are obtained. This exercise should be repeated, two or

three times a day, for a period which may be gradually lengthened from ten minutes, at first, to an hour or more, as the patient becomes accustomed to the treatment.

The use of digitalis when the heart begins to grow weak, expectorants when the bronchitis causes a troublesome cough, careful attention to hygienic surroundings, often a change of climate—all these have their place in certain cases.

Interlobular Emphysema—Emphysema Pulmonum Interlobulare.

PATHOLOGICAL ANATOMY. *Interlobular emphysema of the lungs* consists in the entrance of air into the meshes of the interfundibular and interlobular connective tissue. This implies a previous rupture of pulmonary air cells. This usually occurs in the anterior portion of the upper lobe of the lungs. The air that escapes into the connective tissue finds its way to the peripheral surfaces of the lungs, where it becomes diffused through the subpleural tissue of the pulmonary lobules, forming visible air-bubbles which may be displaced by pressure, causing their movement along the lobular boundaries. In like manner air finds its way through the interstices of the connective tissue along the blood-vessels and bronchi as far as the root of the lungs, whence it may be still further diffused throughout the mediastinal spaces and the subcutaneous tissue of the neck and greater part of the body.

ETIOLOGY. Rupture of the air cells of the lungs may be produced by direct violence such as is experienced when the thorax is crushed under the wheels of a vehicle, or by excessive inflation of the lungs in the endeavor to produce artificial respiration in newborn children who do not breathe. It may also occur as a consequence of excessive muscular effort during temporary closure of the glottis, such as happens in violent coughing, straining, or extraordinary use of the voice. It, consequently, sometimes occurs in connection with any form of obstruction of the air passages.

SYMPTOMS. This form of pulmonary emphysema can seldom be recognized during life, unless it may have attained to the production of subcutaneous emphysema. Before acceptance of the diagnosis in such cases the possibility of the escape of air through the rupture of the bronchi, trachea, larynx, or œsophagus, must be excluded. Pneumothorax can only be ascribed to this after exclusion of all other causes.

TREATMENT. Subcutaneous emphysema that results from alveolar rupture requires no special treatment, since the air is spontaneously absorbed. Cough and discomfort must be relieved by the use of narcotic remedies.

Pulmonary Collapse—Atelectasis Pulmonum.

Pulmonary collapse occurs as a consequence of the absence of air and other substances from the alveolar cavities. This may be produced—(1) by the persistence of the ante-natal condition in certain portions of the lungs, as may be sometimes observed after difficult or premature delivery. Sometimes the respiratory passages are ob-

cted by the inhalation of mucus during the first act of inspiration, thus certain portions of the lung fail to receive air; in other cases strength and excitability of the infantile tissues is deficient through erfect development, consequently the entrance of air into the nchi does not sufficiently excite the respiratory centres in the lulla oblongata. (2) *Obstructive atelectasis* is produced as a conse-nce of bronchial obstruction which prevents the dependent portion he lung from obtaining a proper supply of air. The alveolar spaces ome, therefore, more or less completely emptied through absorption heir gaseous contents. This form of the disease most frequently urs in connection with the capillary bronchitis of children, as may observed in the course of measles, whooping-cough, or bronchial htheria. In like manner the intrusion of blood or other foreign ies into the bronchi may lead to collapse of the dependent pul-nary territory. In rare instances the same result may follow pression of the bronchus by a tumor. (3) Portions of the pul-nary tissue may undergo collapse as a consequence of direct pressure rted by accumulations of air or liquid in the pleural cavities, or by development of any other intra-thoracic disease or deformity which y exert continuous pressure upon the lungs or upon any portion of m. (4) *Marasmic collapse of the lungs* is sometimes developed in course of long and wasting diseases, most frequently in typhoid er, and in the chronic diarrhœa of children. In such cases, pro-ssive failure of muscular power and diminution of the irritability of respiratory centres in the medulla oblongata concur with prolonged intenance of the recumbent position to prevent sufficient expansion the lungs. Under such circumstances, certain portions of the icular structure fall into a state of collapse.

PATHOLOGICAL ANATOMY. Very seldom does any considerable tion of a single lobe or of the entire lung become collapsed; it is ually restricted within particular lobular limits. *Congenital lectasis* most frequently occurs in the lower portion and anterior rder of the lung. Those forms of the disease which depend upon *truction or marasmus*, principally affect the lower and posterior rtions of the lungs. Collapse that is produced by *compression of lung substance* is located in correspondence with the source of essure.

Atelectasis is usually manifested in the peripheral portions of the ngs. When dependent upon bronchial obstruction it exhibits the m of a cone, with its base at the pleural surface and its apex at the int of obstruction. Collapsed structures appear shrunken and of a rk-red, brown, or gray color. Artificial inflation of the lungs pro-ces distention of the sunken portion, followed, in recent cases, by storation of its normal color.

The collapsed tissues do not crepitate on pressure, but have a tough, metimes leathery, feeling; and on incision, air-bubbles do not pear with the fluid discharge that escapes from the air cells and onchi. Fragments of the tissue sink when placed in water.

It not unfrequently happens that the collapsed portions of the lungs come surrounded by an emphysematous zone (vicarious emphysema), or

they may become hyperæmic (carnification), and may pass into a condition of actual inflammation. Instead of inflammation, the process of exudation may become limited to the accumulation of serum and débris in the air cells, producing a close resemblance to the substance of the spleen (splenification).

SYMPTOMS. *Congenital pulmonary collapse* may be best observed at the time of birth. Instead of the vigorous outcry and active movement by which the newborn child announces his arrival, the occurrence of atelectasis is indicated by insufficient and intermittent respiration, indisposition to movement of the limbs, cyanosis, feeble and frequent pulse, and inability to nurse. Death often occurs after spasms and convulsions.

The occurrence of pulmonary collapse at a later period of life is indicated by respiratory insufficiency, with the physical signs that indicate the absence of air from a circumscribed portion of the lungs. An especially characteristic sign is presented by the diminution of dulness and crepitation which may occur after deep inspiration and change of position, by which air is made to enter the collapsed alveolar spaces. Partially collapsed portions of the lung may yield a tympanitic sound on percussion.

DIAGNOSIS. Pulmonary collapse must be differentiated from *pneumonia*, *hemorrhagic infarction*, and *pleurisy*. From the first it may be distinguished by alterations of the percussion sound that are effected by change of position and by deep inspiration.

Hemorrhagic infarctions are characterized by the occurrence of bloody expectoration, and by the coexistence of conditions which favor embolism. *Pleurisy* may be recognized by the horizontal limitation of dulness, and by the diminution or absence of vocal fremitus.

The characteristic history in each case will often aid in clearing up a doubtful diagnosis.

PROGNOSIS. The prognosis is so far dependent upon the amount of collapse, and upon the causes by which it has been produced, that no general rule can be laid down. Each case must be judged by itself.

TREATMENT. Prophylactic treatment is applicable to that class of cases which occur in the course of long-continued and exhausting diseases. Such patients should be frequently placed in different positions, and should receive such therapeutic care as will obviate the tendency to depression of the respiratory centres. Congenital atelectasis requires the ordinary measures for the removal of slimy obstructions from the air passages. Frequent changes of position, and gentle irritation of the skin by friction and by alternate applications of warm and cold water, are usually sufficient to effect the expansion of the lungs; though sometimes the condition of collapse persists for many days, or even longer. The occurrence of atelectasis in the course of diseases at a later period of life calls for especial attention to predisposing disorders, and to the promotion of respiration by the use of expectorants, stimulants, tonics, etc.

Pulmonary Hypostasis—Hypostasis Pulmonum.

ATHOLOGICAL ANATOMY. In all cases of protracted disease asso-
d with weakness of the heart and great physical exhaustion there
nger of *blood-stasis in the posterior and inferior portions of the*
s, if the patient remain long in the recumbent position without
ge of attitude. The dependent portions of the lung become dark in
r, and, on section, appear to be saturated with a dark, sticky,
dy fluid. The *capillary vessels* in the walls of the air cells are dis-
ed, and project into the alveolar spaces which are occupied by the
portion of the blood that is transuded. A certain number of *white*
red blood-corpuscles and the remains of the *alveolar epithelium* are
d with the transudate. The microscopical appearances, therefore,
iderably resemble those that accompany catarrhal inflammation;
they are unattended by fever or by the other symptoms of inflam-
on. The general appearance and consistence of the lungs recalls
of an enlarged and softened spleen, hence the term *splenification*
is applied to this condition.

TIOLOGY. *Pulmonary hypostasis* occurs most frequently as a con-
ence of infective fevers, notably during the later stages of typhoid
r, when the patient lies inert and feeble, in the same position for a
period of time. Other diseases of an exhausting character, espe-
y when they occur at an advanced age, or are of a character to
rfere seriously with the movements of the lungs, are liable to be
nded by the development of hypostasis.

YMPTOMS. The symptoms of *blood-stasis in the lungs* are often
rlooked by reason of the severity of the primary disease in connec-
with which it is developed. Frequently the symptoms of increasing
lyxia afford the earliest indication of pulmonary obstruction. Per-
sion indicates *dulness over the lower portion of both lungs*, if the
sal position has been long maintained. *Respiratory sounds* are
inished, and *crepitant râles* are audible, unless the air cells are
pletely occupied by the liquid transudate. If air has been com-
tely expelled from the affected portion, the physical signs of *pneu-*
nia are present.

IAGNOSIS. From *pulmonary collapse* it is difficult to distinguish
monary hypostasis. In like manner it is often difficult to distinguish
rom *inflammation of the lungs*, unless one is acquainted with the
vious history and course of the disease. From *œdema of the lungs*
may be distinguished by circumscribed dulness on percussion, and
a less extensive development of moist râles throughout the lungs.

ROGNOSIS. The prognosis depends upon the nature of the predis-
ing disease and condition of the patient.

REATMENT. The occurrence of pulmonary hypostasis should be, so
as possible, avoided by attention to the position of the patient, who
t be moved in bed as often as every two or three hours. Weakness
he heart must be anticipated and obviated by the use of cold baths
antifebrile remedies, associated with large doses of alcohol. If
r cardiac stimulants are needed, camphor, musk, ammonia, strych-
e, or capsicum may be administered.

Œdema of the Lungs—Œdema Pulmonum.

Etiology. *Œdema of the lungs* signifies a saturation of the pulmonary tissues and air cells with a serous liquid derived from the capillary vessels. *Acute œdema* may be developed in the space of a few minutes, and may complete its course within a few hours. *Chronic œdema* may continue for a longer period of time. Transudation may occur in a limited portion of a single lung, or it may quickly occupy the entire lung on both sides of the thorax. The independent existence of pulmonary œdema is a very rare thing, though its rapid development may occur after exposure to slight causes, or even without any apparent exciting cause, when a predisposition to the event already exists as a consequence either of *cardiac*, or *pericardial*, or *renal*, or *any other disease by which blood-stasis within the lungs* may be favored. Especially is this the case when dilatation and hypertrophy of the right ventricle are associated with an enfeebled condition of the left ventricle, as in cases of mitral stenosis. It is probable also that the occurrence of cachectic conditions, such as may be originated by the development of *cancer*, or *tuberculosis*, or *chronic nephritis*, may occasion a modification of the capillary walls by which transudation into the air cells and surrounding tissues is facilitated. The existence of *circumscribed inflammation* in any portion of the lungs is frequently followed by the development of œdema in the adjacent portions of those organs.

Pathological Anatomy. On removal of the thoracic wall, the lungs appear enlarged, and do not collapse. Pressure with the finger upon the surface of the lungs causes a depression that persists for a little time in proportion to the loss of elasticity by the pulmonary connective tissue. On section of the lungs, the air cells and smaller bronchi appear to be filled with a serous, frothy liquid which may be either transparent or more or less tinged with blood. The previous occurrence of icterus gives it a yellowish color, and other diseases or conditions which have imparted to the lungs an unusual tinge, give also to the œdematous fluid a similar tint.

Symptoms. *Pulmonary œdema* obviously interferes with the aëration of the blood in the lungs, consequently the symptoms are largely those of progressive asphyxia Respiration becomes accelerated and laborious. The integuments are cyanosed, the mind becomes clouded, muscular spasms may occur, and death finally results from suffocation.

In the early stage of the disease there is usually a very *copious expectoration* of thin, frothy liquid, frequently resembling soapsuds; sometimes these frothy sputa are more or less tinged with blood. They contain very little mucin, and a few white corpuscles and epithelial cells from the alveolar spaces As the strength of the patient fails, the air passages cease to discharge their contents, and the trachea and bronchi are filled with a bubbling liquid which can be no longer expectorated, but remains to impede respiration and to accelerate the development of asphyxia.

Percussion indicates little change from the normal sounds. *Auscultation* discovers all forms of moist râles and rhonchi which occupy the bronchi throughout the affected portion of the lungs. In severe and

ensive cases they may be heard over the whole extent of the thorax, are audible at a distance from the patient, constituting the "death-tle" which is developed during the later stages of the disease.

PROGNOSIS. The prognosis in cases of pulmonary œdema is always y grave, not only in consequence of the resulting asphyxia, but by son of the diseases which may exist as its predisposing cause. Death ietimes so rapidly follows its development that the disease has been en called *pulmonary apoplexy*.

TREATMENT. Since the occurrence of pulmonary œdema is generally endent upon cardiac failure, it is desirable to guard the heart against of the possible causes of exhaustion, especially during the course acute or chronic diseases that are liable to such termination. Symp-ns of œdema should be at once followed by the administration of diac stimulants. Hot foot-baths and sinapisms should be extensively plied. Expectoration should be facilitated by the use of stimulant pectorants, such as squills and senega. The aromatic spirits of am-nia may be given in half-drachm doses every fifteen minutes. An cellent cardiac stimulant may be formed by the association of camphor d capsicum with benzoic acid.

R.—Pulv. gum. camphor. } āā gr. x.
Pulv. capsici. }
Acid. benzoic. ℈ijss.—M.

Div. in chart. no. x. S.—One powder every two hours.

Strychnine (gr. $\frac{1}{20}$, hypodermically every four hours) is very useful en cyanotic discoloration of the lips appears. Emetics should gen-ally be avoided, on account of their depressing influence, which favors e progress of asphyxia If these remedial measures fail to give relief, eat benefit is often obtained from venesection, by which the over-stended right ventricle is relieved and the general circulation of blood aided. If the abstraction of blood should seem undesirable, somewhat milar results may be obtained by ligation of the extremities.

Catarrhal Inflammation of the Lungs—Pneumonia Catarrhalis.

Catarrhal inflammation of the lungs consists in the extension of cute catarrhal inflammation from the bronchioles into the air cells of he lungs. For this reason the disease is frequently termed *broncho-neumonia*. It usually occupies circumscribed portions of the lungs, ence the term *lobular pneumonia*, by which it has been frequently nown.

ETIOLOGY. *Catarrhal pneumonia* is always a secondary disease, equently occurring as a complication of the *infective diseases*, or, as consequence of the extension of *capillary bronchitis* into the alveolar ssages and air cells. It is, therefore, frequently observed among eble and cachectic children, especially during the period of dentition, hich acts as a predisposing cause of disease involving the respiratory paratus. It is also a common event among old people, and among ose who have previously experienced the disease, especially when ex-sed to cold, damp weather, such as occurs during the early and later onths of winter.

Among the exciting causes of catarrhal pneumonia must be reckoned the *intrusion of foreign bodies into the smaller bronchi;* but it is probable that these act chiefly as vehicles for the transport of the parasitic agents by which inflammation is excited, notably *streptococcus pyogenes* and *staphylococcus pyogenes aureus et albus.* Occurring in association with recognized infective diseases, it is probable that the action of their contagia serves to prepare the way for the proliferation and specific effects of these microörganisms.

PATHOLOGICAL ANATOMY. *Catarrhal pneumonia* occurs in the form of disseminated inflammatory areas which are sometimes very numerous, though seldom contiguous. These inflammatory indurations may vary in size from the head of a pin to a walnut. Sometimes a number of such distinct areas become confluent and constitute a genuine lobar pneumonia.

The favorite seat of catarrhal inflammation is in the subpleural tissues, in the posterior and inferior portions of the lungs near the spinal column, upon one or both sides of the thorax. In these localities the substance of the lungs feels as if occupied by indurated masses, which, upon section, exhibit a dark-red color, and contain no air in the alveoli. The incised surface is smooth and shining, without the granular appearance that is visible on incision of a lung that has undergone fibrinous inflammation. The adjacent *bronchi* contain a muco-purulent secretion which sometimes appears to have undergone coagulation and degeneration, so that it can be pressed out of the tubes in the form of a cylindrical, semi-solid, cheesy mass.

It is not an uncommon event to find other portions of the lungs in a *state of collapse*, indicated by the fact that they can be inflated through the bronchi, and that detached portions will float in water, showing that the vesicular structures still contain air. The anterior borders of the lungs have sometimes undergone compensatory inflation, so that the heart may be quite concealed from view. The *pleural surfaces* and the *bronchial lymph glands* almost always participate in the inflammatory process, though not to the extent of serous or purulent effusion into the pleural cavities.

Microscopical investigation indicates dilatation of the capillary vessels in the walls of the air cells, with serous exudation into the alveoli, which are occupied by a mixture of detached epithelial cells, blood corpuscles, and serum, together with the parasitic microörganisms which excite the inflammatory process.

SYMPTOMS. So frequently is *catarrhal pneumonia* associated with other diseases that its symptoms cannot always be dissociated from those of the primary disease. Its *duration* is always exceedingly variable; acute cases being terminated within one or two weeks, while subacute cases generally last for one or two months, and chronic forms may continue much longer. The *febrile movement* by which it is accompanied is subject to great variations of intensity and persistence. Remissions, intermissions, and relapses are not uncommon. As a general rule the fever presents a daily morning remission, and its termination is gradual, instead of critical. The *temperature* in acute cases is high, so much so that its persistent elevation above 102° F. in

s of apparent bronchial catarrh should lead to the suspicion of an ciated broncho-pneumonia. The movements of the *pulse* and of *iration* are greatly accelerated. Often each expiration is termi- d by a moan, and respiration may be irregular and intermittent. act of coughing is often attended with pain, and pressure upon the t frequently causes indications of suffering. In severe cases iratory dilatation of the nostrils and retraction of the intercostal es and floating ribs may be observed. *Dulness on percussion*, with ease of vocal fremitus, occur only when an area of inflammation is ast as extensive as the pleximeter that overlies it. It is over the erior part of the lungs, on one or both sides of the thorax, that dulness mes evident. Sometimes it acquires a tympanitic character through ipse and relaxation of the lung substance in the immediate neigh- ood of the seat of inflammation.

uscultation discovers crepitant and sibilant râles, but bronchophony bronchial breathing are only perceptible when the area of inflamma- is considerably extended.

Expectoration is usually absent in young children and old people. h sputa as are discharged are muco-purulent and, sometimes, tinged blood.

Recovery is gradual and often interrupted by relapses that are caused he lighting up of new centres of inflammation. *Fatal cases* are the lt of progressive exhaustion, or cardiac paralysis, or asphyxia. ong children Cheyne-Stokes respiration, or muscular spasms, not equently terminate the course of the disease.

n severe cases various *septic complications* may occur. Cutaneous cesses, or even gangrene have been sometimes observed, and catarrhal ammation of other organs may coexist. The *serous membranes* of body may also become involved in the inflammatory process; and, lly, *tuberculosis* may invade the weakened tissues.

DIAGNOSIS. A positive diagnosis is not always possible in cases of arrhal pneumonia. It may be distinguished from *pulmonary collapse* its greater persistence, and by its independence of changes of posi- n or respiration. From the infiltration of *tuberculosis*, it may be tinguished by the absence of tubercle bacilli in the sputa. From *rinous pneumonia* it may be distinguished by the absence of rusty ta; by its variable duration; and by the existence of multiple foci inflammation.

PROGNOSIS. The prognosis is always very grave. Under unfavor- le circumstances the disease is almost inevitably fatal; and, at best, out one-third of the cases fail of recovery.

TREATMENT. The patient should be placed in a spacious, well- tilated apartment, in which the temperature is constantly maintained 70° F., and the air is continually moistened with the spray of warm ter. The surface of the body should be sponged with tepid water ry morning and evening, and fever may be combated by the admin- ration of acetanilide or phenacetine in doses of two to ten grains cording to the age of the patient. Pain may be relieved by warm ultices applied to the chest. The occurrence of bronchial râles is an lication for the use of expectorants, or of emetics if there be great

obstruction of the air passages (p. 444). If a tendency to asphyxia become apparent, warm baths and the administration of strychnine will be found useful. Showering the occiput with a stream of cold water, or sprinkling the chest with cold water while the rest of the body is immersed in a warm bath, have been recommended for the purpose of arousing the respiratory centres in the medulla oblongata. In all cases the diet should consist of broths, milk, eggs, and a moderate allowance of alcoholic stimulants.

Fibrinous Pneumonia—Pneumonia Fibrinosa.

Fibrinous pneumonia is an infective disease characterized by a febrile movement, and by a local inflammation through which the air cells of one or more lobes of the lungs are filled with a fibrinous exudation which may also involve the bronchi and infundibular passages.

ETIOLOGY. The active agent in the production of pneumonia is a microörganism, the so-called *pneumococcus.* (Fig. 101.) It is probable

FIG. 101.



Diplococcus pneumoniæ. (HALLOPEAU.)

that several allied species exist which possess the power of exciting pneumonic inflammation, and it is not improbable that the varieties of inflammation which have been observed are due to corresponding variations in the character of the bacterial cause. The same parasite is endowed with the power of exciting inflammation upon the serous membranes in other parts of the body, *e. g.*, the pleura, the pericardium, the peritoneum, and the meninges of the brain. The greater proclivity of the inferior lobe of the right lung to pneumonia, is supposed to depend upon the fact that the right bronchus is larger than the left; hence, infected air carries the contagion more readily into the right lung, where the action of gravity causes its principal accumulation in the lower lobe. The inferior lobe of the left lung stands next in the order of liability to infection, then follow the middle and upper lobes of the right lung, and last of all, the upper lobe of the left lung. The influence of *cold* in the production of pneumonia is probably restricted to its action as a predisposing cause by which the resistance of the pulmonary tissue is reduced, so that the bacterial contagion is left free to exert its deleterious influence.

Fibrinous pneumonia occurs much more frequently among men than among women, and it attacks old people rather than those in earlier life. Enfeeblement of the health, delicacy of organization, and previous experience of the disease also act as predisposing causes.

The occurrence of pneumonia as an epidemic disease has often been observed in certain localities, notably in places where unhygienic surroundings and overcrowding favor the prevalence of infective disease;

s it has been observed as a local epidemic in barracks, jails, alms-ses, and in the habitations of the poor. The season of the year and character of the weather exert great influence upon the prevalence the disease; it is more common during cold, damp weather in the er part of winter and in early spring than during the dry, warm aths of the year.

Secondary pneumonia sometimes develops during the course of the ptive fevers, and during the final stage of chronic diseases, like ght's disease, diabetes, cancer, etc.

PATHOLOGICAL ANATOMY. The course of fibrinous pneumonia may divided into three stages: congestion, hepatization, and resolution. ese stages are not sharply defined, but may be found concurrently eloped in different portions of the same lung. (1) The *stage of gestion* is characterized by great accumulation of blood in the affected tion of the lung, which is considerably swelled, pits on pressure, and nore or less destitute of air in the alveolar spaces. Microscopical mination discovers the usual vascular changes that occur in inflam-tion. The epithelium of the air cells is largely exfoliated, degener-d, and mixed with extravasated white and red corpuscles of the blood ating in a sticky, albuminous fluid that is exuded from the capillary sels. (2) The *stage of hepatization* is characterized by complete ence of air from the alveolar spaces, and their occupation by the ducts of exudation which have undergone coagulation. The sub-nce of the lung is converted into a firm, resistant mass, which sinks water, and does not bleed on incision. The incised surface presents granular appearance like that which is presented by a similar section the liver. The color of the hepatized lung is at first a dark red, ich is gradually replaced by a brownish-red, and, finally, by a gray lor (gray hepatization). (3) The *stage of resolution* is characterized fatty degeneration of the products of exudation. The inflamed por-on of the lung is occupied by a puriform fluid which can be expressed om the smaller bronchi, and which, by careful exposure to a current water, may be washed out of the air cells without injury to their ructure. A considerable portion of the resolving exudate is thrown f by expectoration, but the greater part is removed by absorption rough the lymphatic channels. With the completion of this process e alveolar epithelium becomes fully regenerated, and the normal nction of the part is renewed.

The *pleural surface* that covers the inflamed portion of the lung sually exhibits a moderate degree of fibrinous inflammation. The *rger bronchi* manifest a state of catarrhal inflammation, but the ronchioles are occupied by the fibrinous exudation that fills the air lls. Occasionally the larger bronchi are similarly obstructed. The *onchial glands* are swelled and hyperæmic. The *right side of the art* is distended with blood which is loosely coagulated, while the *left de* is empty. The *muscular substance of the organ* appears flaccid, d sometimes gives evidence of granular or fatty degeneration. The *dominal organs* exhibit a condition of venous hyperæmia. The *liver* enlarged with blood; the *spleen* is also swelled and softened in a anner that is characteristic of infective diseases. The *kidneys* fre-

quently exhibit the characteristic changes of catarrhal inflammation. The *mucous membrane of the intestinal canal* is in a similar condition, and the vessels of the brain appear distended with blood.

SYMPTOMS. The length of the period of incubation in pneumonia is unknown, and is probably of variable duration. Different observers have estimated it all the way from two days to three weeks.

Fibrinous pneumonia usually commences suddenly with a severe *chill* and *pain* in the affected side that are succeeded by *fever*, with the usual symptoms of burning heat, dry skin, suffusion and injection of the eyes, circumscribed redness of the cheeks which is sometimes visible only upon the side that corresponds to the inflamed lung. The *tongue* is thickly covered with a gray or yellowish coat, and in severe cases becomes dry and brown, sometimes fissured and bleeding. The *pulse* and the *respiration* are accelerated. There is *pain* and uneasiness in the affected portion of the chest, increased by cough and deep respiration. The *urine* is scanty, high colored, acid, and often contains a small quantity of albumin; the chlorides are present in diminished quantity. The *bowels* are constipated, and the *feces* are dry and diminished in amount. The *sputa* are at first colorless, tenacious, and very slightly frothy, very soon becoming darker from admixture with the coloring matter of the blood, and assuming the characteristic rusty color.

After the expiration of twelve or twenty-four hours the physical signs of *exudation* begin to appear. At first, they indicate the presence of liquid in the air cells; then succeed the evidences of pulmonary consolidation; and, finally, during the stage of resolution, renewed evidences of liquid in the air cells and bronchioles are apparent. The physical signs, therefore, vary with the course of the disease, and correspond with the changes that are produced by the processes of exudation and absorption

Inspection indicates an abridgment of the respiratory movements upon the affected side of the thorax. The patient frequently lies upon that side, so as to restrict, as far as possible, all movement of the inflamed lung. *Palpation* discovers an increased vocal fremitus over the seat of inflammation as soon as the air cells become filled with the coagulated exudate by which the conductivity of the lung substance is augmented. In this way the waves of sound that originate in the larynx and are propagated through the trachea and the bronchi are readily transmitted to the surface of the thorax. It must not be forgotten that vocal fremitus is normally more perceptible upon the right side of the thorax than upon the left, and that its transmission to the surface may be temporarily arrested by any transient obstruction of the principal bronchus upon the affected side. In such cases, however, the disappearance of fremitus is not permanent, and its normal development is renewed so soon as the bronchial obstruction has been removed by a paroxysm of cough.

Extensive infiltration of the lung causes a notable increase in the circumference of the affected side.

During the stages of hyperæmia and resolution, *percussion* yields a resonant sound, which is replaced by complete dulness during the stage

epatization. The tympanitic quality of the percussion note is due somewhat flaccid condition of the walls of the air cells during the od when their contents are yet gaseous. Occasionally the "cracked-" sound is audible during percussion, when the mouth is opened. he inflamed portion of the lung be covered to a considerable depth ealthy, vesicular tissue, dulness may fail to be elicited by percus-; and if the seat of inflammation is superficial, it must occupy a e of at least three inches in diameter, with a thickness of an inch, re it can yield distinct dulness in response to percussion.

uscultation during the stages of hyperæmia and of resolution dis-rs the existence of fine, crepitant, inspiratory râles over the ted portion of the lung; they are most audible near the end of the iratory act. These râles are produced by the movement of the olar walls in contact with the sticky exudation that partially fills air cells. During the stage of hepatization, crepitant râles disap-, but sibilant râles may be heard in the bronchi. Bronchial thing is also audible, and bronchophony is increased in consequence e superior conductivity of the consolidated lung substance. Some-s ægophony becomes audible.

he *appearance of the sputa* possesses great diagnostic importance; e commencement of the disease they are colorless, and so tenacious they will not flow out of an inverted spittoon; they are often aked with blood, but, presently, they assume a characteristic rusty r, which is observed in scarcely any other disease, and is caused he presence of pigment derived from the red blood-corpuscles; the l quantity that is expectorated is not great, rarely exceeding eight en ounces in the twenty-four hours. Besides the blood corpuscles, nd cells, alveolar and bronchial epithelium, pneumococci, and ious microörganisms of inflammation and suppuration, the sputa tain numerous fibrinous casts of the bronchioles and infundibular sages, similar to those which are formed in certain cases of fibrinous nchitis. During the period of resolution, the sputa assume a yel-ish color, and, finally, present the characteristics of an ordinary co-purulent expectoration.

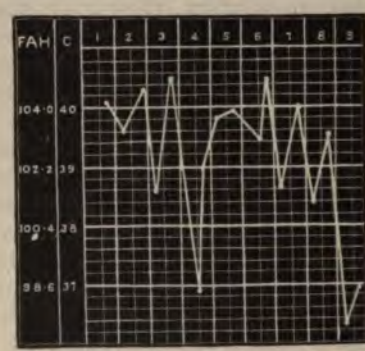
he *temperature* varies, during the course of fibrinous pneumonia, ween 102° and 106° F. The fever is continued, and usually minates by crisis between the fifth and eighth days. (Fig. 102.) e temperature falls in the course of a few hours, sometimes reaching subnormal level. In certain cases, crisis is preceded by consider-e increase in the severity of all the symptoms. Sometimes the ical fall of temperature is followed by an immediate renewal of er and high temperature, which again subsides critically after a iod of two or three days. Occasionally, fever continues in a remit-t form for a week or more after the normal critical point has been sed, and then rapidly subsides by lysis. (Fig. 103).

he commencement of crisis is usually attended by copious perspira-, followed by deep, and refreshing sleep. The urine becomes more ndant, and deposits a considerable quantity of reddish-brown sedi-nt of urates.

he course of the *pulse* follows that of the temperature; at first it is

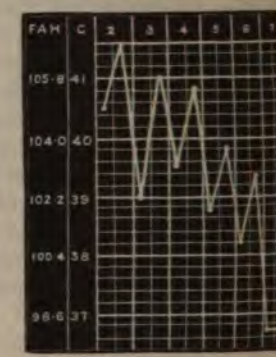
full, strong, and incompressible. Among adult patients it usually beats from 100 to 120 times a minute; a rate of 130 to 140 per minute indicates great severity and danger. Young children frequently exhibit a pulse of 200 beats per minute. During crisis the pulse is sometimes depressed below the normal figure; if it be retarded during the height of the fever, it is probable that some complication exists in connection with the heart or with the brain; irregularity and intermission of the pulse are indicative of cardiac debility.

FIG. 102.



Crisis. Temperature in lobar pneumonia. Sudden crisis on eighth day; pseudo-crisis on fourth day. (WUNDERLICH).

FIG. 103.



Lysis. Temperature in broncho-pneumonia. Gradual fall extending over four days. (WUNDERLICH).

The movements of *respiration* are accelerated during the period of fever, reaching 30 or 40 respirations every minute; among children they may run as high as 100 per minute.

Pain about the level of the nipple, upon the affected side, is a very common symptom. It is increased by cough and by movement of the body, and is, probably, occasioned by the pleuritic inflammation that accompanies pulmonary infiltration. *Consciousness* usually remains undisturbed throughout the course of the disease. Sometimes there is slight *delirium*, and *sleep* may be disturbed by dreams, or may be entirely prevented by a distressing cough. An *eruption of herpes* frequently occurs about the lips of the patient; it is sometimes observed elsewhere upon the face, or upon the surface of the body. Since it is rarely present in cases of typhoid fever, its eruption may assist the diagnosis in doubtful cases. Other *exanthematous eruptions* have been observed, such as erythema, roseola, urticaria, pemphigus, or purpura. Miliaria usually appears during protracted perspiration.

In addition to the ordinary form of fibrinous pneumonia above described, various departures from the typical species have been observed. Sometimes the attack is aborted within a few hours after the appearance of characteristic symptoms, before the complete development of the stage of hepatization. Such cases are described as *aborted pneumonia*. Sometimes *the fever lingers* for two or three weeks, and terminates gradually by lysis, while the physical signs of consolidation

in for several weeks longer. Sometimes the process of exudation infiltration *pursues an erratic and serpiginous course*, reminding of the progress of erysipelas, with which, in fact, it may be occally associated. In such instances the spleen becomes extraordiy tumefied. Again, this erratic form of pneumonia may occur in iation with *acute inflammatory rheumatism*, giving occasion for a f in its rheumatic origin and character. In certain cases the early toms of pneumonia may recur at regular periods that are id by *malarial infection*. Such cases may sometimes be promptly ved by large doses of quinine; but sometimes a fatal termination ot be prevented. It rarely happens that pneumonia runs its course out the manifestation of febrile symptoms. In other cases the disassumes an *asthenic form* which indicates a high degree of infection. characterized by great prostration and cardiac debility; there is fever, nervous irritability, delirium, or the development of an ietic, *typhoid condition*. Exudation occurs frequently in the upper of the lungs, or upon both sides of the chest. Expectoration may sent, or of a distinctly hemorrhagic character. Considerable alburia is generally observed. The skin frequently assumes a jaundiced Abscess or gangrene of the lungs not unfrequently occur; also inflammations, such as pericarditis, meningitis, gastro-enteritis, and death is the usual termination of the disease. This form of monia is frequently known as *typhoid*, *malignant*, or *bilious pneuia*. It is more often observed in warm weather, and in southern ides, than during the winter months.

he chill with which pneumonia is usually introduced is generally nt *when the disease attacks children*. It is replaced by a period of iolence, or by vomiting, or by convulsions which so commonly acterize the commencement of other infective diseases among chil. Nervous symptoms are often observed during its course, and the ination is usually gradual instead of being abruptly concluded by s. The indications derived from characteristic sputa are usually nt, because children and old people almost always swallow their a.

Pneumonia among old people is ordinarily characterized by an dious invasion, and by the rapid development of a tendency to prosion and cardiac debility. *Intemperate people*, besides a predisposito the occurrence of pneumonia, manifest a very marked tendency ie development of delirium tremens and other evidences of complete ous exhaustion. The disease is liable to be complicated with other equences of chronic alcoholism.

s a result of the tendency, in certain cases, to a generalization of exciting cause of pneumonia, other diseases are not unfrequently ciated with inflammation of the lungs. *Bronchitis* and *pleurisy* frequently coexist with the original disorder. In like manner *carditis* or *pericarditis* may be set up through the invasion of the iac apparatus by infective pneumococci and pyogenic germs. The rcurrence of *icterus* may be caused by a simple catarrhal inflammaof the duodenum, by which the outflow of bile into the intestine is ented; or it may be produced by interference with the circulation

of blood in the liver; or as a consequence of the extension of inflammation from the right lung and diaphragmatic pleura to the hepatic peritoneum. The occurrence of jaundice often affords an unfavorable augury, since bile pigments and biliary acids are powerful heart poisons which greatly diminish the vigor of that organ. The presence of bile pigment in the sputa gives them a grass-green color which is valuable as a diagnostic indication

Albuminuria occurs in about one-half of the cases of pneumonia; it is the result of irritation or inflammation of the kidneys with the pneumonic contagion, and it speedily disappears as soon as that is eliminated.

The occurrence of *delirium tremens* in alcoholic patients, and the manifestation of nervous symptoms in connection with fever, have already been mentioned. It sometimes happens that *meningitis* may occur as a result of infection of the meninges by pneumococci and pus microbes as they diffuse themselves throughout the body. The meningeal inflammation follows the pulmonary disease after the lapse of a few days. *Death* may occur speedily, before the occurrence of any considerable meningeal exudation; or it may be delayed until purulent effusion has been fully developed.

Like other infective diseases, pneumonia may be accompanied or followed by septic complications, multiple abscess, gangrene, purulent inflammation of the parotid gland, pulmonary abscess, and, occasionally, by paralysis. Chronic interstitial inflammation of the lungs, pulmonary tuberculosis, and insanity, have also been observed after pneumonia.

Diagnosis. Among the most characteristic evidences of *fibrinous pneumonia* must be ranked the occurrence of rusty sputa, though, for the reasons that have been previously mentioned, sputa of any kind are frequently absent. The occurrence of saffron-colored sputa indicates the commencement of resolution; grass-green sputa accompany icterus; a liquid, frothy, prune-juice sputum indicates a tendency to pulmonary œdema. In the absence of sputa, pneumonia may be frequently inferred from the course and critical termination of the fever, which must also be taken into consideration in estimating the value of the physical signs, since crepitant râles occur in œdema and in hemorrhagic infarcts of the lungs; while sonorous râles and increase of vocal fremitus and bronchophony, together with dulness on percussion, and bronchial breathing, are developed whenever the alveolar spaces are occupied by any substance that excludes air. In *pleurisy with effusion*, dulness, bronchial breathing, ægophony, and sonorous râles may be present; but vocal fremitus is diminished instead of being increased as it is in pneumonia. The upper limit of dulness, moreover, is horizontal, or nearly so, in whatever position the patient is placed. In doubtful cases experimental puncture of the thorax will indicate the presence of fluid if pleurisy exist.

The occurrence of *cerebral* or *abdominal symptoms* may sometimes excite hesitation with regard to the nature of the disease. Roseolous eruptions favor the diagnosis of *typhoid fever*, which may be rendered certain by the discovery of typhoid bacilli in the stools, or in blood taken from the rose spots. The occurrence of *herpes* is an argument

favor of pneumonia. In doubtful cases the lungs should be most efully and repeatedly examined.

PROGNOSIS. The prognosis of simple *fibrinous pneumonia*, occurg in a young and healthy subject, under favorable conditions uncomcated by alcoholism, is very favorable; but old people, children, nkards, and the victims of other infective diseases yield a very favorable prognosis. Location of the disease in the upper lobes of lungs; the occurrence of delirium tremens; a temperature exceed- 104° F.; extensive inflammation, especially if it involve both gs; pregnancy, and the coexistence of other pulmonary or cardiac eases, add greatly to the dangers of pneumonia. The mortality ies considerably, according to locality and occasion; but averages far from 20 per cent.

TREATMENT. Like other uncomplicated diseases which pursue a finite course, simple fibrinous pneumonia occurring under favorable ditions requires very little active treatment. The patient should be ced in a well-ventilated apartment in which the air is kept moist h a spray of warm water, at a temperature of 72° F. The diet uld consist of liquids; lemonade and cold water may be given ely, together with a well-diluted solution of phosphoric acid.

℞.—Acid. phosphoric. ʒjss.
Aquæ Oss.—M.
S.—A tablespoonful every two hours.

But old people, children, drunkards, and patients in whom pneunia has been developed as a secondary disease, must be treated very ferently. The danger of cardiac failure is such that every effort st be made to support the strength of the heart. For this purpose e remedies which reduce temperature must be administered, viz., tipyrine (sixty to ninety grains dissolved in a little warm water, and jected into the rectum); acetanilide (five grains every two hours), or enacetine (ten to fifteen grains every two hours). Antipyrine thus ed does not produce the nausea and vomiting which sometimes follow administration by the mouth. Alcoholic stimulants must also be ministered freely; they may be given in the form of strong wine, or hiskey diluted with water; an ounce of sherry, or half an ounce of hiskey, or even a larger quantity, may be administered every hour in thenic cases. It is well to change the alcoholic stimulant from time time, so as to avoid the disgust which sometimes arises if the patient confined to one variety of wine or liquor alone. Quinine, salicylic id, benzoate of sodium, tartar emetic, veratrum viride, digitalis, and nesection are remedies to be avoided rather than employed in pneuonia. If alcoholic and antifebrile remedies fail to obviate the tenncy to collapse, it will be necessary to administer camphor, capsicum, musk, which may be given in grain doses every hour. A tendency to anosis may frequently be arrested by the administration of strychnine:

℞.—Strych. sulph. gr. j.
Quin. sulph. gr. viij.
Acid. sulph. aromat. ʒss.
Aquæ camphor. ʒxvss.—M.
S.—A teaspoonful in water every two hours.

The occurrence of bronchial catarrh may render necessary the use of expectorant mixtures.

℞.—Apomorphin. gr. j.
Acid. hydrocyan. dilut. ♏xv.
Glycerinæ ℥ss.
Aquæ camphor. ℥jss.—M.
S. —A teaspoonful every two to four hours.

℞.—Syr. ipecac., Tr. opii camphorat. ā ā ℥ss.
Glycerin. ℥j.—M.
S.—A teaspoonful every two to four hours.

Pain in the side may be relieved by the application of dry or wet cups, or a half-dozen leeches, and by large poultices surrounding the affected side of the thorax. In the treatment of young children an oiled-silk jacket, lined with soft flannel, is frequently a sufficient substitute for poultices. Insomnia may be relieved by the use of chloral hydrate in thirty-grain doses, at bedtime, or by the administration of paraldehyde in drachm doses, or of sulphonal in half-drachm doses. In all cases of pneumonia, narcotics should be employed with the greatest caution, by reason of the great tendency to cardiac paralysis and collapse which characterize the disease. Only in cases of uncomplicated pneumonia occurring under favorable circumstances, in young and healthy persons with a vigorous heart and no apparent tendency to cyanosis, should opiates be administered.

During convalescence the ordinary therapeutic measures may be employed, including good diet and careful avoidance of exposure, on account of the strong tendency to collapse that often exists; iron, quinine, and strychnine will be found useful in small doses.

Interstitial Pneumonia—Pneumonia Interstitialis.

Acute interstitial inflammation of the lungs involves the interlobular connective tissue, and cannot be distinguished during life from abscess of the lungs. *Chronic interstitial inflammation of the lungs* is generally a secondary disease, occurring in connection with chronic bronchitis, pleurisy, and any form of disease involving the lungs. A senile proliferation of the pulmonary connective tissue has sometimes been described, but the disease is usually of a secondary character.

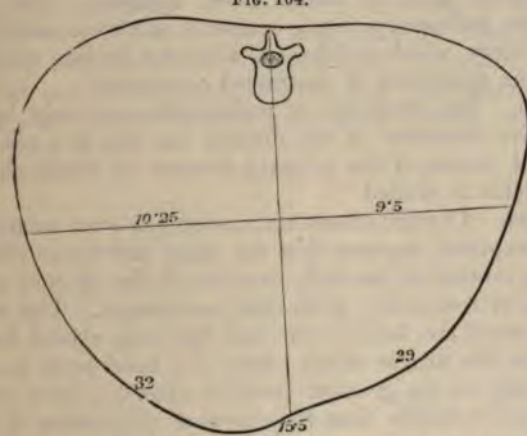
Pathological Anatomy. *Chronic interstitial pneumonia* may exist in the form of *circumscribed indurations* of a light-gray or pink color, or of a very dark and slaty hue. The *diffuse form* of the disease is manifested by the existence of white, gray, or slate-colored striæ which envelop the pulmonary lobules of the lungs, and compress the air cells. As the disease progresses, the inflamed tissues contract, and, consequently, the pleural surface of the lungs becomes uneven, like the corresponding surface of the liver or of the kidneys when those organs have undergone inflammation and contraction of their connective tissue (cirrhosis).

Since chronic interstitial pneumonia is usually a secondary consequence of other pulmonary diseases, the pathological changes which

racterize the primary disease will also be present, *e. g.*, abscess, grene, caseous deposits, tubercular cavities, bronchitis, etc.

SYMPTOMS AND DIAGNOSIS. *Chronic interstitial pneumonia* can y be recognized during life when it has progressed to the extent of ducing considerable contraction of the affected portion of the lung. cumscribed forms of the disease may be surrounded by a zone of arious emphysema, by which the effects of contraction may be com- tely masked. When existing in the circumscribed form, it is most ily recognized at the apex of the lung; the space below the clavicle n appears sunken, and is dull on percussion. If the whole lung be olved, the entire half of the thorax appears contracted and dimin- ed in size (Fig. 104). The corresponding shoulder droops, and the er portion of the shoulder-blade projects away from the thoracic ll. The movements of respiration are much restricted upon the

FIG. 104.



Unilateral retraction of the chest; consequent upon cirrhosis of the left lung in a girl fourteen years. The figures indicate antero-postero and transverse diameters, and micircles of right and left chest. (DR. GEE.)

ffected side. As a consequence of contraction of the left lung the eart may be unusually exposed, so that its pulsations become extra- rdinarily visible. Sometimes the organ is drawn upward by the re- ractile process, so that the apex pulsates in the fourth intercostal space; nd it may be in the same way drawn outward as far as the axillary ine. In such cases the systolic dilatation of the pulmonary artery may e perceived in the second left intercostal space.

Palpation indicates reduction in the width of the intercostal spaces, iminution of the respiratory movements, together with increased vocal remitus if the vesicular structures are extensively destroyed by com- ression. If, however, the bronchi have been themselves obliterated y the contractile process, vocal fremitus will be correspondingly iminished.

Percussion indicates dulness and diminution in the volume and obility of the lungs. In cases complicated by the formation of pul-

monary cavities, tympanitic and metallic sounds will be heard on percussion. As a consequence of vertical contraction of the lungs, the apex may be drawn below its normal level, and the base of the lungs may occupy a higher plane. Thus the liver may be displaced above its natural position without enlargement of its volume.

Auscultation indicates the absence of respiratory sounds over the contracted portions of the lungs. Bronchial breathing will be audible if the bronchi remain uninjured. The existence of pulmonary cavities occasions the occurrence of sonorous râles, with bronchophony and bronchial breathing characterized by a metallic resonance (amphoric or cavernous respiration). The cardiac sounds are very distinct, and the diastolic sound over the region of the pulmonary artery is accentuated.

The occurrence of chronic interstitial pneumonia occasions more or less respiratory insufficiency, which is characterized by breathlessness, rapid respiration, and, in severe cases, cyanosis. The increase of pressure in the pulmonary artery occasions dilatation and hypertrophy of the right heart, which is followed, when the cardiac muscle fails, by the well-known symptoms of obstructed circulation.

PROGNOSIS. The prognosis is unfavorable, not only by reason of the progressive character of the disease, but also as a consequence of the dangerous nature of the primary diseases by which chronic interstitial pneumonia is excited.

TREATMENT. Chronic interstitial pneumonia is an incurable disease. The only therapeutic measure that can exert any direct effect upon its consequences consists in the daily exercise of the affected side, in unilateral cases, by respiratory gymnastic movements. The body should be inclined toward the healthy side, and the lungs should be repeatedly inflated, while the arm is raised above the head so as to expand the contracted lung to its greatest possible extent. Such treatment is said to give better results than the alternate respiration of compressed and rarefied air.

Pulmonary Abscess—Abscessus Pulmonum.

Pulmonary abscess is a rare disease, more frequent among men than among women.

ETIOLOGY. Suppuration of the pulmonary tissue is excited by the pyogenic micrococci, notably staphylococcus pyogenes aureus. It frequently follows fibrinous pneumonia, especially when the upper lobe of the lung has been involved. Catarrhal inflammation, emphysema, indurations of the lungs, embolisms of the branches of the pulmonary artery, if derived from infective sources, injuries, and foreign bodies in the bronchi, may all act as exciting causes of pulmonary abscess.

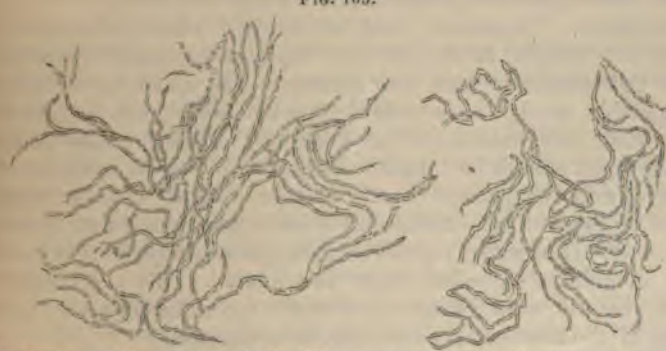
PATHOLOGICAL ANATOMY. The occurrence of a *pulmonary abscess* implies the existence in the lungs of a cavity that is filled with pus. Its size may vary from that of a pea to that of an orange. It may occupy the entire lung. The cavity of the abscess is irregular in form, and sometimes consists of a number of communicating spaces. The inner surface is uneven, roughly villous, and is covered with a thick

er of yellowish or gray pus. The periphery of the abscess is sur-nded by a capsule consisting of pulmonary connective tissue which undergone chronic interstitial inflammation. Pulmonary abscesses y be single or multiple. They are usually situated in the upper e of the lung.

Symptoms. The most important symptom of *pulmonary abscess* is nished by the expectoration of *pus which contains shreds of broken-wn pulmonary tissue.* The quantity of the sputa may vary from f a pint to a quart each day. It is sometimes thrown up in large uthfuls, after the patient has for some time lain upon the affected e so that the cavity has become filled with pus. If any obstruction event its free discharge, putrefaction may occur within the cavity of e abscess, producing an offensive odor which disappears if free vent given to the pus. Permanent obstruction may lead to the develop-nt of pulmonary gangrene.

Microscopical examination of the débris contained in the sputa in-ates the presence of elastic fibres from the connective tissue frame-rk of the air cells, mixed with degenerated epithelium, fat crystals, sses of pigment, hæmatoidin, and various microörganisms. (Fig. 5.) The pus from a chronic pulmonary abscess contains fewer

Fig. 105.



Elastic fibres of lung tissue obtained from sputa after digestion in caustic soda. (Drawn by Dr. John Wilson.)

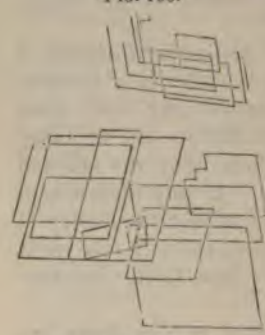
sicular elements and a larger amount of fibres derived from the in-rated connective tissue which has been the seat of chronic inflamma-on. Cholesterine tablets are also visible in the expectorated matter. Fig. 106.)

Abscesses of considerable size which lie superficially may be recog-ized by the ordinary physical signs of a pulmonary cavity, viz., *ulness*, if the cavity is filled with pus, and a *metallic resonance* when is distended with air; *elevation of the pitch* and "cracked-pot ound" when the mouth is open; *bronchial breathing* and *sonorous ales.*

Hectic fever and *rapid emaciation* characterize the progress of the sease, which may either terminate in recovery and cicatrization, or e inner surface of the abscess may become transformed into a fistulous

passage, continually discharging pus or muco-pus. *Death* may result from exhaustion, or from suffocation through rupture of an abscess into the air passages, or as a consequence of gangrene. Sometimes pus may find its way into the pleural cavity, or into the liver, or it may excite pericarditis, or it may penetrate the thoracic wall and escape externally.

Fig. 106.



Crystals of cholesterine. (Otto Funke.)

Diagnosis. *Pulmonary abscess* may be distinguished from abscesses which have found their way from other organs into the lungs by the history of the case, by the evidences of disease in the organs where suppuration originated, and by the absence of pulmonary débris. Pus derived from a tubercular cavity in the lungs may be recognized by the presence of tubercle bacilli. *Gangrene of the lungs* is indicated by the horribly offensive sputa, which contain mycotic plugs in which microscopical examination discovers the presence of leptothrix pulmonalis.

Prognosis. Pulmonary abscess is a very dangerous disease; still recovery takes place in a considerable number of cases.

Treatment. Treatment must be directed with a view to the preservation of strength, to the arrest of suppuration, and to the prevention of putrefaction within the abscess. The diet must be nutritious and digestible, alcoholic stimulants must be freely given, together with iron, quinine, strychnine, and cod-liver oil. Several times a day the air of the room should be sprayed with a two per cent. solution of carbolic acid, and the patient may be made to inhale vapors impregnated with oil of turpentine, carbolic acid, salicylate of sodium, benzoate of sodium, etc. Internally, myrtol may be given in doses of two or three grains, in gelatin capsules, every two hours. This last remedy appears to be the most reliable antiseptic for internal use. External pointing of the abscess calls for surgical treatment.

Gangrene of the Lungs—Gangræna Pulmonum.

Gangrene of the lungs consists in the death and putrefaction of the pulmonary tissue. It is a very rare disease, occurring more frequently among men than among women, during the early and middle period of adult life.

Etiology. *Pulmonary gangrene* occurs usually among the victims of poverty and intemperance who have been subjected to over-crowding in damp and ill-ventilated quarters. It occurs, sometimes, after severe *infective diseases*, or during the course of *diabetes mellitus*. The exciting cause is found in the activity of pyogenic microörganisms, chiefly staphylococcus pyogenes aureus et albus. When these organisms are comparatively few in number, they produce *pulmonary abscess*, but their extensive multiplication excites *necrosis of the pulmonary tissue*, which then, if in communication with the external air, becomes infected

he entrance of putrefactive bacteria, and the phemonena of gangrene thus completed.

ulmonary gangrene is generally preceded by local disorders, such *ronchiectasis with putrid bronchitis*, or the *entrance of foreign es into the air passages*. Perforation of the air passages, during course of malignant or degenerative diseases in neighboring organs, lead to the introduction of foreign substances into the lungs, with equent gangrene as a consequence. A similar accident may occur ng the process of artificial feeding, in cases of insanity and the like. *Diseases of the pulmonary tissues*, viz., inflammation, abscess, tuber-sis, or parasitic growths, may give origin to the gangrenous process. *Embolic obstruction* of the pulmonary vessels with infective masses ved from peripheral sources may also originate the gangrenous pro-; thus the occurrence of bedsores, diphtheritic diseases of the skin, rperal infection, abscess of the liver, caries of the petrous portion of temporal bone, etc., may furnish infective material. In like man-wounds and injuries of the lungs may be followed by gangrene.

ATHOLOGICAL ANATOMY. *Pulmonary gangrene* may exist in the n of circumscribed areas of variable size, which are either single or tiple; or it may be diffused without clearly defined limits, through-extensive portions of the pulmonary substance, sometimes involving entire lung. This form of the disease is more frequently observed he upper lobe and in the right lung.

Circumscribed gangrene is also observed more frequently in the right g than in the left, and in the peripheral portions of the lower lobe, her than in the middle or upper lobe.

The gangrenous process commences with the *formation of a dark ugh*, similar to that which is formed by the action of caustic potash n the external surface of the body. The slough softens, is saturated h an ichorous fluid, and is gradually discharged with the expectorated tters, leaving an irregular cavity filled with stinking, purulent, ichorous shreddy fluid. Communicating bronchi open abruptly into the ity, and their mucous lining exhibits a condition of acute inflamma-which, sometimes, reaches the height of putrid bronchitis and achiectasis. The neighboring bloodvessels are generally obstructed obliterated; though, sometimes, a rapid process of mortification les their walls and occasions hemorrhage.

The gangrenous cavity is surrounded by a zone of interstitial inflam-ion by which it is encapsulated. Recovery is effected by contrac-of this capsule, and by the formation of granulations upon its inner face which finally close up the cavity. Sometimes, however, the ling process is incomplete, and there remains a pyogenic membrane ch continues to discharge pus. Tumefaction of the bronchial glands erally accompanies the occurrence of gangrene.

YMPTOMS. Small circumscribed gangrenous masses which do not mmunicate with the external air may sometimes remain without mptoms. The occurrence of *fever*, with profuse perspiration and at prostration, accompanied by a horrible odor proceeding from lungs, affords presumptive evidence of pulmonary gangrene; but most characteristic evidence is furnished by the *stinking sputa*,

in which may be discovered the débris of the pulmonary tissue. When allowed to settle in a glass, the sputa separate into three layers, of which the upper contains pus corpuscles and mucus; the middle layer consists of a gray, serous fluid containing isolated flakes; while the lower layer contains a granular sediment and pulmonary débris.

The débris of the lungs consists of shreddy masses which are formed by the disintegrated connective tissue of the vesicular structures. Numerous oil globules, fat crystals, and masses of black pigment, lie in the network, together with granular particles which may be recognized as specific microörganisms.

Besides the above-mentioned bodies there may be observed numerous mycotic masses derived from the smaller bronchial passages; these exhale a frightful odor, and consist of crystals of the fatty acids and of hæmatoidin, associated with oil globules, red blood-corpuscles, and parasitic organisms. Certain of these resemble the well-known leptothrix buccalis, but, in consequence of slight differences, have been named leptothrix pulmonalis. These organisms are considered the active agents by which the pulmonary tissues are disintegrated and brought into the state of putrefaction.

Fever, marked by severe chills and copious perspiration, usually occurs in connection with pulmonary gangrene. Its course is irregular, and, sometimes, interrupted by intermissions of variable duration. It is evidently dependent upon general infection of the blood. The *pulse* is small, weak, and frequent. *Emaciation* and *debility* are rapidly developed.

Diffuse gangrene gives occasion for the ordinary physical signs of pulmonary infiltration, viz., dulness, bronchial breathing, sonorous râles, increase of vocal fremitus and bronchophony. A *circumscribed gangrenous cavity* gives occasion for the ordinary physical signs of a pulmonary cavity, viz., tympanitic resonance on percussion, elevation of pitch, and cracked-pot sound on percussion when the mouth is open, sonorous râles, etc. Obviously the character of the signs will differ in accordance with the contents of the cavity, which responds with a dull sound when filled with liquid, and with a resonant thrill when it is filled with air.

Among the *complications of pulmonary gangrene*, *hæmoptysis* is a frequent occurrence. It may become a source of danger if very profuse. Sometimes *pleurisy* or *pyo-pneumothorax* result from the extension of the gangrenous process and perforation of the pleura; or as a consequence of infection of the pleural surfaces with microörganisms which have found admission through the lymph channels. Sometimes, in consequence of pleuritic adhesions, the thoracic wall is directly penetrated, and the contents of the gangrenous cavity find exit upon the surface of the body. *Gastro-intestinal disturbances* and *diarrhœa* are, sometimes, excited by the infection of the alimentary canal with the contents of sputa which have been swallowed. Generally, *septic processes* and *pyæmia* may result from *universal infection* through the medium of the circulatory fluids.

Diffuse pulmonary gangrene may run its fatal course within a few days. A circumscribed form of the disease may linger for many weeks

months. *Recovery* is preceded by gradual subsidence of the symp-
ıs, disappearance of fetor, and cessation of discharge. *Incomplete*
very implies the persistence of a pus-forming cavity in which putre-
tion may again arise. *Fatal cases* are frequently preceded by the
elopment of a typhoid condition, with delirium, local spasms, a dry,
wn tongue, and other symptoms of universal prostration.

DIAGNOSIS. Pulmonary gangrene may be distinguished from *putrid*
nchitis by the absence of pulmonary débris from the sputa of bron-
tis. From *empyœma* which is discharged through the lungs it
y be distinguished by the exclusively purulent character of the dis-
ırge in that disease. The *offensive expectoration* which is sometimes
erved in pulmonary consumption may be distinguished by the pres-
e of tubercle bacilli. *Offensive breath*, which is dependent upon
er causes than gangrene and putrid bronchitis, may be distinguished,
the absence of sputa, by the fact that its intensity is aggravated by
ır approach to the mouth of the patient, while the stench of gan-
ne uniformly pervades the atmosphere of the apartment in which
patient lies.

PROGNOSIS. The prognosis is very unfavorable, though cases of
cumscribed gangrene not unfrequently recover, especially when youth
l previous health concur to increase the power of resistance.

TREATMENT. The patient must be supported with abundant nourish-
nt, and with alcoholic stimulants which not only increase the vigor
the heart, but serve to disinfect the contents of the stomach if gan-
enous sputa have been swallowed. The air of the room should be
quently disinfected with carbolic acid spray (two to four per cent.) or
th the vapor of hot water containing oil of turpentine. The sputa
ould be carefully disinfected with carbolic acid, or permanganate of
tassium, or chloride of calcium. The patient should be provided
th a mask for inhalation, by the aid of which he should as often and
long as possible inhale the vapor of carbolic acid, which, as rapidly
it can be tolerated, should be increased in strength from a five per
nt. to a fifty per cent. solution, or even stronger. Poor people who
nnot procure such apparatus may inhale the vapor of turpentine
ixed with hot water in a narrow-necked jug or flask, or they may use
pasteboard cone containing a quantity of cotton saturated with the
rbolic acid solution. Permanganate of potassium (0.1 to 0.5 of one
r cent.), boric acid (1 to 4 per cent.), benzoate of sodium (5 to 10 per
nt.), salicylic acid (0.2 to 1 per cent.), and other disinfectants, may be
ed in the same way. For internal administration, myrtol, in doses of
) to three grains, in gelatin capsules, every two hours, is most highly
ommended. Eucalyptol and other disinfectant remedies have also
en administered, but without much success. Minor indications, such
cough, hæmoptysis, vomiting, and diarrhœa may require the adminis-
tion of opiates and astringents.

Pulmonary Cancer—Carcinoma et Sarcoma Pulmonum.

ETIOLOGY. *Cancerous diseases of the lungs* occasionally occur as a
nary affection. Usually, they are secondary results of a pre-

existing development in other parts of the body. Sarcoma occurs very rarely in comparison with carcinoma.

PATHOLOGICAL ANATOMY. *Encephaloid forms of cancer* are of most frequent occurrence in the lungs, but all the varieties may exist. The disease develops as a diffuse infiltration, or as a circumscribed tumor. In either case, the whole lobe or the entire lung may be invaded by the disease. In some cases the lungs are occupied by numerous, minute, cancerous tumors which greatly resemble a disseminated miliary tuberculosis. The non-indurated varieties often exhibit a soft, creamy consistence, and their interior sometimes undergoes fatty degeneration and evacuation through the neighboring bronchi. Calcification, or ossification, may sometimes occur.

The favorite seat of cancerous growth is in the upper lobe of the right lung, which is invaded twice as often as the left lung. Sarcoma originates in the connective tissue, while carcinoma is of epithelial or endothelial origin. Besides the lungs, other intra-thoracic organs may become involved in the carcinomatous process.

SYMPTOMS. The symptoms of *pulmonary cancer* depend upon the extent and locality of the disease. *Diminution of respiratory space* in the lungs is indicated by shortness of breath, cyanosis, and irregular respiratory movements. If the heart and large veins be compressed, there will be *disturbances of the circulation*. As the vesicular structure of the lungs is replaced by the new growth, the symptoms of *pulmonary consolidation* will be developed. Associated inflammations of the bronchi and tissues adjacent to the cancer will originate the symptoms of *bronchial catarrh* or of *pulmonary inflammation*. If the cardiac region be invaded, the *heart* will be displaced by the tumor. As the thoracic cavity becomes filled by the new growth, its walls become elevated and fixed; sometimes the tumor may actually project between the ribs. The superficial veins frequently become dilated and distended from interference with their discharge into the internal vessels, consequently the *subcutaneous connective tissue spaces* in the arms, face, neck, and thorax become distended with fluid, and the *lymph glands* in the neck and in the armpit become tumefied. The *sputa* frequently contain blood mixed with mucus, in appearance closely resembling currant-jelly. Similar sputa, it is true, may be occasionally observed in pulmonary consumption. Occasionally there is developed a grass-green color, due to transformation of blood pigment. Frequently cancerous elements can be discovered in the expectorated masses. If decomposition take place within the lungs, the sputa sometimes emit an offensive odor. If *pleurisy* with effusion be excited by the cancerous disease, the contents of the pleural cavity contain characteristic cells which indicate the malignant nature of the disease.

Death sometimes occurs suddenly from copious hemorrhage. Sometimes it results from asphyxia or from exhaustion. The disease may sometimes be mistaken for pleurisy when the pulse upon the affected side is weaker than upon the other side, and when through compression of the large arteries a systolic murmur is produced.

PROGNOSIS AND TREATMENT. The prognosis is invariably bad, and treatment can accomplish nothing more than the relief of pain and suffering.

CHAPTER VI.

DISEASES OF THE PLEURA.

Pleurisy—Pleuritis.

ETIOLOGY. *Pleurisy* is an exceedingly common disease. In ancient ies it was supposed that pleuritic adhesions represented the normal ndition of the parts, and that freedom of the opposite surfaces was the nsequence of disease. Age and sex confer no immunity against the ease; it has been observed in fœtal life, and old people not unfre- ently experience it. More common among men than among women ring the period of active life, it is obviously so on account of e greater degree of exposure which then occurs.

Pleurisy is almost invariably excited by certain *microörganisms* nich find access to the pleural membrane. Among these the pneumo- ccus and the pyogenic cocci are the most conspicuous. Tubercle cilli may attack the pleura, and give occasion for the commencement inflammation.

As *predisposing causes* which favor the invasion of microörganisms. ust be enumerated exposure to cold and wet, with the occurrence of fective diseases, and of such disorders as interfere with metabolism nd elimination; also blows, wounds, inflammation in neighboring rgans, and other disorders of the pleura itself.

PATHOLOGICAL ANATOMY. *Pleurisy* may exist either with or with- ut liquid effusion. The *first form* (dry pleurisy—pleuritis sicca) is haracterized by a fibrinous exudation. The *second variety* (pleurisy ith effusion, pleuritis humida) is characterized by a liquid effusion hich may be either serous, purulent, bloody, or ichorous. Interme- iate varieties also exist, in which the products of exudation partake of wo or more forms.

All varieties of pleurisy commence with dilatation of the bloodvessels, hich causes a circumscribed, or more or less diffuse, redness that ap- ears either in the form of patches, striæ, or of universal congestion of he serous surface. At certain points hemorrhagic extravasations may e visible beneath the endothelial layer. As the inflammation progresses he elements of the serous and subserous tissue become swelled and osened by the incipient effusion. The shining, serous surface becomes ull and velvety, like a tarnished mirror. The surface becomes still ore roughened by the formation of a fibrinous, coagulable exudation om the capillary vessels. Numerous embryonic round cells are ntangled in the meshes of the coagulum. In simple, *fibrinous pleurisy* e exudative process proceeds no further, but the opposite pleural sur- ces become adherent through opposition of the inflamed membranes. loodvessels and connective tissue are developed out of the embryonic ells which proliferate abundantly in the exudate. In this way the

visceral pleura becomes firmly connected with the costal pleura by the development of bands and cords like those which may be seen after fibrinous inflammation of the pericardium. If, however, the disease does not progress to universal adhesion, partial adhesion may become established between the lobes of the lungs, or between the basal surfaces of the lungs and the upper surface of the diaphragm where the movements of respiration do not disturb the pleural walls. Recession of the disease may occur without adhesion, when the products of exudation undergo degeneration, and are removed by absorption.

Pleurisy with effusion begins with inflammatory changes that are identical with those which have been already described; but the exudate contains very little coagulable fibrin, and consists chiefly of a serous fluid which contains flakes of fibrin, isolated blood corpuscles, endothelial and embryonic cells. Between the lobes and at the base of the lungs, a certain amount of fibrinous exudation is generally deposited, and circumscribed flocculent masses of fibrinous exudation occasionally appear upon the free surfaces.

Suppurative pleurisy (pyothorax, empyema) is characterized by the presence of a greenish-yellow exudation which consists of pus corpuscles floating in a more or less abundant serous liquid. A certain amount of fibrinous exudation is usually evident. The pus may be thick and creamy like that of an ordinary abscess, or it may be largely diluted with serum.

Hemorrhagic pleurisy is characterized by the bloody character of the exudation, which may be bright and fresh, or of a dark brown color. The blood corpuscles may exist in all stages of degeneration, and the color of the exudation varies greatly, from the brilliant color of fresh blood, to the dark lake color of thoroughly disintegrated corpuscles.

Ichorous or *putrid pleurisy* is characterized by the presence of a gray or dirty brown fluid which exhales an offensive oder. It occurs as the result of decomposition in the purulent or hemorrhagic exudation, and is usually dependent upon pyæmia, septicæmia, pulmonary gangrene, or putrid bronchitis.

Sometimes the exudation of pleurisy exhibits a *milky appearance* due to the presence of oil globules, granular matter, and cholesterine. Sometimes also the exudate undergoes *colloid degeneration*, so that the pleural cavity is occupied by a viscid fluid. These peculiar transformations may be associated with the development of *cancerous disease of the pleura*.

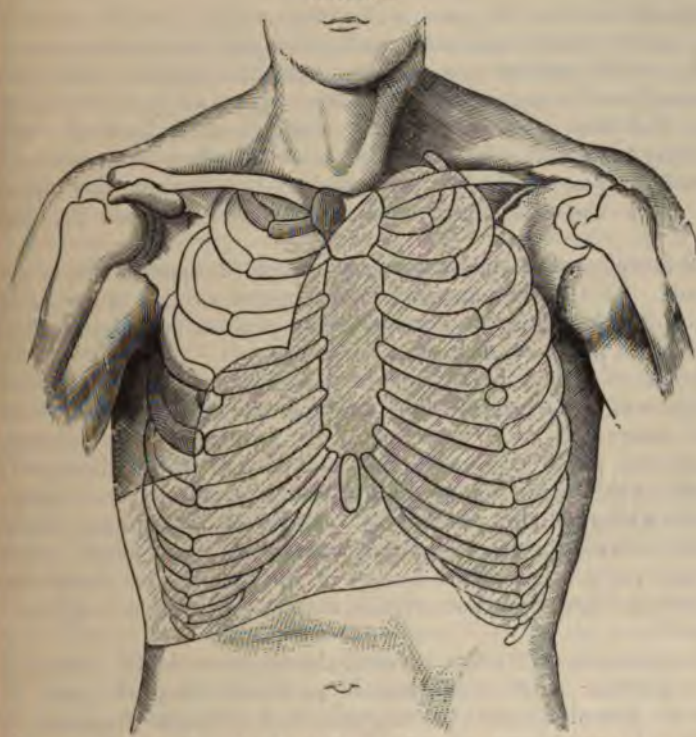
The *quantity* of a pleuritic exudation is exceedingly variable, sometimes amounting to several gallons, in other cases to a half ounce only. Its specific gravity varies from 1015 to 1023. A fluid of less density is probably a mere dropsical transudate. A specific gravity above 1018 quite certainly indicates an inflammatory exudation.

The liquid mass, in a pleuritic effusion, is seldom free to move without hindrance in the pleural cavity. Sometimes numerous bands of adhesion transform the space into a sort of sponge with coarse meshes through which the fluid finds its way. Sometimes the fluid is imprisoned by adhesions, constituting what is known as *encysted*

risy. When several cysts exist, they constitute *multilocular risy.*

Extensive exudation necessarily produces more or less *displacement the thoracic and abdominal viscera.* The *lung* may be compressed completely emptied of air, so as to resemble a small spleen flat- ed against the spinal column. (Fig. 107.) The *heart* may be

FIG. 107.



splacement of mediastinum and left lobe of liver from pleuritic effusion on the left side. The shading indicates the extent of dull percussion. (FINLAYSON.)

shed far over into the right side of the thorax, in cases of effusion o the left pleural cavity, or in the opposite direction if the effusion upy the right side of the chest. Great depression of the diaphragm y drag the heart downward, and be accompanied also by depression the liver or of the spleen according to the side upon which the sion exists. It is obvious that the concurrence of tumors or other al diseases within the abdominal or thoracic cavities may originate nifold variations from the simple types of displacement.

SYMPTOMS. *Pleurisy* may exist without any recognizable symptoms, en a circumscribed fibrinous effusion is formed without pain or inter- ence with the functions of other organs. *Secondary pleurisy* may o be overlooked in consequence of the prominence of the symptoms ich characterize the primary disease. As a general rule, however,

acute pleurisy is ushered in by chills and by a fever which continues in a more or less acute and continuous form for three or four weeks, and then subsides as the local changes within the pleural cavity recede. Subacute forms of the disease frequently exhibit longer duration with an irregular course of the fever. Chronic pleurisy may linger for months or even for years. The general symptoms do not always correspond with the amount of local change. Extensive exudation is sometimes accompanied by moderate fever, and *vice versâ*.

Pleuritis sicca. Dry pleurisy is characterized by the existence of *pain*, and by *friction sounds* which accompany the movements of respiration. The patient generally lies upon the unaffected side, because pressure over the region of inflammation causes an increase of pleuritic pain. For this reason the spinal column is laterally flexed with the convexity toward the healthy side, so as to relax the tension of the inflamed surfaces. Sometimes, however, the patient lies upon the back, and as the disease progresses he may even lie upon the diseased side.

The movements of *respiration* are restricted upon the side that is inflamed. If the inflammation be restricted to the upper or lower portion of the pleura, the corresponding portion of the thoracic wall will be fixed and as immovable as possible.

Palpation confirms the evidence afforded by inspection as to the restriction of movement in the affected portion of the thorax. Pressure in the intercostal spaces over the seat of inflammation occasions an increase of pain. By careful observation of the indications thus afforded as the finger follows the different intercostal spaces around the thoracic wall, the limits within which pain is experienced may be clearly defined. It must not be forgotten, however, that the actual inflammation may extend beyond the borders of the painful area, which usually occupies the lower portion of the anterior and lateral walls of the thorax.

The existence of *friction* between the opposite pleural surfaces occasions a peculiar thrill which may be perceived when the palm of the hand is placed against the thoracic wall (*pleural fremitus*). The sensation is somewhat similar to that which is produced by bending to-and-fro a piece of new sole-leather. Such fremitus, however, may be frequently and for a long time absent. Sometimes it can be felt only at the end of inspiration, and it is generally intensified by an increase of respiratory motion. Pressure upon the intercostal spaces sometimes increases its intensity. Vocal fremitus is not affected by the occurrence of dry pleurisy, since the amount of exudation is not sufficient to interfere with the normal propagation of vocal sounds through the respiratory passages. Percussion also indicates no change unless there is liquid effusion.

The *respiratory sounds* appear very weak and interrupted upon the affected side. The *friction sounds* vary greatly; sometimes they are audible to the patient himself, and may be heard at a considerable distance from his body; sometimes they are soft and insignificant; not unfrequently they are interrupted as if the movement of the pleural surfaces upon each other were effected by an intermittent slipping

f a continuous excursion. The sound is usually most audible
d of inspiration; sometimes it can only be heard during deep
l respiration; it can sometimes be heard during both phases of
ratory movement; it is a rare thing to hear it during expira-
. Pressure upon the thoracic wall also increases its intensity.
during which it can be heard is exceedingly variable, since it
so largely upon the amount and character of the exudate. It
audible over the lower portion of the anterior and lateral
the thorax. When it is audible over the apex of the lung it
lly associated with tubercular deposits in that region.
is a common accompaniment of pleuritic inflammation. Some-
is trifling and easily overlooked; in other cases it adds greatly
ufferings of the patient. The occurrence of bronchial catarrh
ecessary for its production. It may be excited by the local
tion alone, since irritation of the pleura is competent to pro-
reflex movements that are connected with cough.
isease frequently commences suddenly, with severe *chills* and a
at is characterized by the usual phenomena. Sometimes a
mount of *cyanosis* accompanies its course.
imes dry pleurisy becomes merged in the form that is char-
by abundant liquid effusion. In such cases the symptoms of
exudation may be succeeded by those of liquid effusion, which,
me, again give place, as the fluid is absorbed, to the signs of
deposit.
ccurrence of extensive adhesions may interfere greatly with
ility of the lungs, or with the circulation of blood. In this
ertrophy and dilatation of the heart may be produced; the
y also become emphysematous through interference with their
xpansion.
itis humida—pleurisy with effusion. A small quantity of
effusion may exist within the thorax without the possibility of
on. The amount must reach fourteen or fifteen ounces before
positively discovered by the aid of percussion. The thickness
uid column between the lung and the thoracic wall must also
ss than an inch. Besides dulness on percussion, the absence
fremitus is also necessary to determine the existence of effu-

tion shows a change in the position of the patient. Instead
upon the sound side, as in dry pleurisy, he now generally lies
diseased side, so as to permit the freest possible motion of the
d lung. Sometimes, however, patients may be discovered
on the back, or even upon the healthy side.
de of the chest which is occupied by effusion is considerably
. It, however, must not be forgotton that the right side of the
enerally measures about an inch in circumference more than
side. The intercostal spaces are increased, and, sometimes,
prominent in consequence of pressure exerted by the liquid
of the pleural cavity. The shoulder is elevated, and the
olumn exhibits a slight lateral curvature, with its convexity
he side of the effusion.

Respiratory movement is considerably restricted, if not wholly abolished, upon the diseased side. Respiration is generally accelerated, and irregular, or interrupted, in consequence of pain on movement. Increased rapidity of respiration is caused partly by the reduction of pulmonary capacity for air, and partly by the disturbances of circulation which depend upon compression of the lungs and heart. Depression of the diaphragm and increase of temperature also tend to accelerate the movements of respiration.

Displacement of the lungs or of the heart by the effusion depends obviously upon the amount of the fluid and upon the mobility of neighboring organs. Previous adhesions may prevent their displacement, even though the amount of exudation be very considerable. When the left pleural cavity is distended with fluid, the heart is displaced toward the right. It is partially rotated upon its longitudinal axis so that the right ventricle may reach beyond the mammary line. At the same time the left half of the diaphragm will be pushed downward, bringing the spleen where it can be felt below the left hypochondrium. The semilunar space, which ordinarily indicates the location of the fundus of the stomach, will also be obliterated by the same downward pressure. When the effusion occupies the right pleural cavity, the apex of the heart may be displaced beyond the left mammary line. The right half of the diaphragm will also be pressed downward, occasioning displacement of the liver, which in thin persons may be recognized below the ribs, and, like the spleen under similar circumstances, may exhibit vertical movements which correspond with the excursions of the diaphragm.

Sometimes *pulsation* is visible upon the side of the effusion. Generally, but not always, this accompanies a purulent exudation.

On *palpation* of the thorax, vocal fremitus is found to be diminished or completely abolished over the seat of the effusion. It must not be forgotten that vocal fremitus is normally more pronounced upon the right side than upon the left. Palpation with the ulnar border of the hand or with the aid of a small piece of wood like a pencil, is found of assistance in locating the boundaries within which fremitus is present or absent. Its suppression is due to the fact that the aërial waves which are propagated from the larynx during vocal utterance, are more completely conducted through the vesicular structure of the lungs to the thoracic wall than they can be conveyed by transmission from the bronchi through a fluid medium. The occurrence of pleuritic adhesions at any point serves as a local medium for the effectual transmission of vocal fremitus, which can then be perceived wherever any considerable adhesion exists.

Pressure with the hand upon the thoracic wall indicates an increased resistance. Gentle tapping with the hand or the finger upon the chest readily furnishes evidence of this condition.

Sometimes it happens that pressure upon the thoracic surface produces pitting, in consequence of *œdema* in the subcutaneous tissue. This may occur with any form of exudation, and is consequent either upon inflammation of the costal pleura (inflammatory œdema), or it may be the consequence of obstruction of the circulation through pres-

upon the large vessels. Fluctuation in the intercostal spaces very ly occurs. When the liver or the spleen have been displaced, they frequently be felt through the abdominal wall. Sometimes a inct furrow can be made out between the upper surface of the liver the diaphragm, but this does not always occur. The protrusion of diaphragm itself can sometimes be recognized below the borders of false ribs.

Percussion indicates dulness over the region of the effusion. The ater the amount of the liquid the higher the upper limit of dulness ng the spinal column; the degree of dulness diminishes with its ent, because the amount of liquid is necessarily greater in the lower rtion of the chest than where it forms a thin layer between the lung and thoracic wall in the middle or upper part of the pleural cavity. When hesions do not exist, the upper limit of the liquid tends to assume horizontal level; but, frequently, dulness is discovered at the gher level behind, rather than in front of the viscera, in consequence the existence of adhesions, which interfere with the free movement of e effusion. Dulness also extends about one inch higher than the vel of the liquid, by reason of the compression to which the lower rtion of the lung, in contact with the liquid, is subjected. For the me reason, in cases of considerable effusion, the percussion in the first d second intercostal spaces gives a deep and tympanitic response. hen dulness occupies the entire half of the thorax, percussion in at locality, especially upon the left side, produces a tympanitic und, of which the pitch is varied by opening or closing the mouth. nder such circumstances, the principal bronchus and the trachea behave ke any other smooth-walled cavities which might exist in the lungs, d yield on percussion a tympanitic resonance, which varies its pitch the mouth is opened or closed. Sometimes, also, a short and sharp low with the percussion hammer produces the "cracked-pot sound," sudden vibratory expulsion of air through the narrow glottis.

Auscultation indicates more or less diminution or complete absence vesicular respiratory sounds, in consequence of the fact that the uid effusion forms an inferior conductor for the aërial vibrations that e generated within the lungs during the act of respiration. For the me reason the sound of bronchial breathing appears exaggerated; ough when the exudation is very abundant, it may be diminished, in sequence of the remoteness of the displaced bronchi, or by reason their actual compression. Bronchial râles will not be audible, unless ere be a complicating bronchitis.

Auscultation indicates an apparent diminution of the vocal sounds, cepting where adhesions between the pleural surfaces may exist. A ited amount of exudation, however, may increase the vocal sounds, consequence of the augmented conductive power of the compressed ng. The same thing may sometimes be observed above the level of e effusion.

It frequently happens that auscultation detects a tremulous and sal quality in the vocal sounds; this is termed *ægophony*, from its semblance to the bleating of the goat. It generally occurs in con- ection with moderate effusions, and is audible along the upper limit

of the exudation. It is produced through the agency of the peripheral bronchial tubes which have been compressed in such a way that they produce a rapidly intermittent transmission of vocal vibrations to the thoracic wall. Excessive exudation obviously crowds the lung too far away to permit such transmission.

The vibrations which are produced by *whispering* are audible during auscultation over the seat of exudation, just as they may be heard over pulmonary cavities or infiltrations of the lungs.

Friction sounds are not uncommon in association with liquid effusion. They may become audible at the commencement of a pleurisy, before the period of effusion; and also at the close of the same, as the liquid subsides. At times they may be heard at the upper limit of the effusion where the pleural surfaces are in contact.

Cough is sometimes dependent upon bronchial catarrh, and sometimes upon inflammatory inflammation of the pleura itself. The intensity and frequency of the cough is subject to great variations.

The general symptoms of pleurisy admit of great variety and number, since every part of the body is liable to be disturbed by the local disorder. High fever occasions heat and redness of the skin; protracted purulent exudations may produce pallor and other evidences of cachexia, with a degree of emaciation suggestive of pulmonary consumption, especially when associated with hectic fever and copious night-sweats, loss of appetite, and strength. Pleuritic fever follows no uniform course; sometimes it may be entirely absent for a considerable period of time. Purulent exudation generally excites an irregular and hectic form of fever. Recovery is sometimes ushered in by a sudden subsidence of fever; but more frequently it recedes gradually.

Vomiting sometimes occurs, apparently by reason of mechanical pressure upon the stomach. The liver is often enlarged through compression of the ascending vena cava. The urine is reduced in quantity, and sometimes contains albumin and casts.

Diaphragmatic pleurisy is a form of the disease which is restricted to the pleural surface of the diaphragm. It is ushered in with severe pain under the hypochondrium, which may extend into the back, or as high as the shoulder, rendering it difficult to lie in certain positions. The act of swallowing is sometimes attended with pain as the alimentary bolus passes through the œsophageal foramen in the diaphragm. Vomiting and hiccough are not uncommon when the left side is involved; while icterus may accompany inflammation of the right side. Pressure along the costal borders of the diaphragm, and over the phrenic nerve in the neck, is painful. Diaphragmatic respiration is more or less completely abolished, causing considerable want of breath. Sometimes friction sounds can be heard along the lower portion of the lung; but dulness on percussion is not apparent unless the amount of fluid exudation be sufficient to encroach upon the lateral region of the pleural cavity.

Pericarditis and *endocarditis* sometimes follow left-sided pleurisy, through the extension of the inflammatory process. *General dropsy* seldom occurs, unless, as a consequence of long-continued empyema,

abdominal organs have undergone amyloid degeneration, or when ignant tumors favor the production of œdema.

High fever is sometimes accompanied by symptoms of *cerebral disance;* and among children *convulsions* may occur. *Sudden death* etimes follows pleurisy with effusion as a consequence of some sual and excessive muscular exertion, or as a consequence of sudden emia of the brain, induced by incautious assumption of the erect ition. Sometimes death is occasioned by embolic processes which ult from the formation of cardiac thrombi dependent upon a feeble culation of the blood. Long-continued exudation may result in rdiac degeneration, with sudden death as a consequence.

Empyema sometimes results in evacuation of the purulent effusion rough the lungs, or into other visceral cavities, or through the exnal wall of the thorax. Such external rupture produces what is called *pyema necessitatis.* Its occurrence is attended by phenomena ich resemble the pointing of an abscess. The cutaneous surface comes œdematous and prominent, and fluctuation may be detected. e swelling appears smaller during inspiration, but it is increased by vements of expiration, and by coughing or straining. Sometimes tumor pulsates in a manner similar to what may be observed in eurismal tumors. Gradually the surface of the skin becomes redned and thinner, until, at last, rupture takes place, and pus streams th. The discharge may resemble the contents of an ordinary abscess udable pus) or it may exhale a sour, or even an offensive smell if air ds access to the pleural cavity. The point of rupture is usually ween the ribs near the sternal border, or in the fifth or sixth intertal spaces between the mammary and axillary lines. Occasionally, istulous passage is formed, through which the pus escapes at a long tance below the thorax.

Sometimes the discharge of pus gradually diminishes, and the healing ocess may be accomplished. Frequently, however, a reaccumulation curs, and the patient finally dies, exhausted by hectic fever and proicted suppuration. Amyloid degeneration may also invade particular gans of the body, producing death from dropsy or diarrhœa. Carious seases of the bones may also complicate the disease.

Empyema may evacuate itself through the lungs by a gradual disarge, or by an overwhelming rush of liquid into the bronchi and ichea, sometimes producing suffocation and death. At first, the pectoration may consist of laudable, or of sour-smelling pus; but, er a time, it frequently acquires the odor of putrefaction, in consequence of the admission of air into the pleural cavity. If the discharge ke place through a valvular opening in the pleural wall, air may ll be excluded from the pleural cavity, and decomposition may thus avoided. Obstruction of the discharge usually occasions an increase fever, which continues until renewed evacuation of pus is effected.

Sometimes pus finds its way from the pleural cavity into the perirdium, or into the mediastinum, or directly into the larger air passages, into the œsophagus, or the alimentary canal below the diaphragm, or o the renal passages.

The pervasive character of the infection by which pleuritic inflamma-

tion is excited is, sometimes, additionally illustrated by the concurrent invasion of the kidneys, producing *acute nephritis*.

The *results* and *sequelæ* of *pleurisy* are exceedingly numerous. A serous effusion is sometimes absorbed, and is followed by complete recovery of the health; but, usually, adhesions between the pleural surfaces are formed and persist throughout the remainder of life. They occasion sharp pain in the sides of the chest, on exertion or in connection with deep respiratory movements. Extensive adhesion causes, under such circumstances, considerable difficulty in respiration. The heart may become involved by the existence of such adhesions, which interfere with the freedom of its action; more or less evidence of extensive and chronic thickening of the pleura is frequently furnished by the persistence of dulness, with reduction of vocal fremitus and respiratory sound in the affected portion of the thoracic cavity. Long-continued compression of the lungs often produces permanent occlusion of the vesicular spaces, so that, after absorption or removal of the liquid effusion, the lungs remain permanently contracted. The thoracic wall, consequently, becomes permanently retracted, partly through the uncompensated pressure of the atmosphere upon the external surface of the thorax, and, partly, as a consequence of direct traction through contraction of the products of exudation. Upon the diseased side the ribs overlap each other; the spinal column exhibits lateral curvature, with its convexity toward the healthy side; the shoulder droops upon the affected side; and the movements of respiration are, for the most part, restricted to the healthy portion of the thorax. The physical signs are those which indicate compression of, or absence of air from, the pulmonary tissue. The heart and liver, if not bound down by previous adhesions, undergo dislocation in correspondence with the locality and the amount of retraction.

One of the most serious consequences of pleurisy is the frequent development of *pulmonary tuberculosis*, either in connection with the disease or as a consequence of its previous occurrence. This misfortune is more likely to follow serous effusion, especially in cases that are marked by a predisposition to tuberculosis, than after well-managed purulent exudation. A neglected empyema may, nevertheless, lead to caseation, or calcification, and bacillary infection of the products of inflammation, with general tuberculosis as the final result.

Diagnosis. *Dry pleurisy* may be easily recognized when friction sounds are audible, but they must be carefully distinguished from other sounds which have their origin within the thorax, viz., bronchial râles and pericardial friction sounds. From *bronchial râles* the friction sound of pleurisy may be distinguished by the fact that pressure with the stethoscope increases a friction sound, while bronchial râles are not thus affected. The act of coughing, by which the air passages are temporarily emptied of their contents, causes a cessation of râles, but has no influence upon friction sound. Bronchial râles are also more generally diffused than friction sounds, which are frequently quite circumscribed.

The occurrence of dry pleurisy in the vicinity of the pericardium occasions a certain amount of confusion, since the sounds are modified

ertain extent by the movements of the heart; but these *pleuro-rdial sounds* may be distinguished by the fact that their re-ory constituent is greatly influenced by variations in the depth of espiratory movements. Holding the breath also causes a speedy pearance of the pseudo-pericardial constituent of the friction sound, reappears as soon as respiration is renewed, while a similar arrest spiration after a deep inspiration causes a considerable increase in tensity of genuine pericardial friction sounds. Pleuro-pericardial n sounds are, also, most distinctly audible near the left border of pex of the heart, while genuine pericardial friction is more audible the middle third of the sternum, and in the third and fourth inter- spaces along the border of the breast-bone.

the absence of pleuritic friction sounds a painful pleurisy must tinguished from *intercostal neuralgia*, from *muscular rheumatism*, *inflammation of the ribs*, and from *cutaneous diseases*. The last be excluded by inspection of the thoracic surface. *Intercostal lgia* is characterized by transient paroxysms of pain which usually only one intercostal space from the spinal column to the sternum. existence of painful points which correspond to the location of the , the lateral, and the sternal branches of the intercostal nerve, hes important evidence of neuralgia. *Caries of the ribs* may be guished by the greater intensity of pain when the ribs undergo ure, while in pleurisy the tenderness is greatest when the inter- spaces are pressed. *Muscular rheumatism* is sometimes difficult tinguish when it affects an extensive territory, and is accompanied inful respiration and its consequences. When the larger pectoral lorsal muscles are involved, their painful condition is increased by ure between the fingers.

eurisy with effusion must be distinguished from infiltration of the by the character of the vocal fremitus, which is diminished in isy but is increased in pneumonia. The concurrence of a pleuritic on with pneumonia will cause the abolition of vocal fremitus over eat of effusion. In like manner, it will temporarily disappear the upper bronchus of a pneumonic lung is obstructed by secre- which exclude the tracheal vibration from the pulmonary territory. listinction between pleurisy and pneumonia may be facilitated, in n cases, by the character and locality of dulness on percussion, dulness in pleurisy increases as the lower portion of the thoracic y is approached. Dulness in its superior portion, while the lower remains resonant, would be decisive in favor of pneumonia or infiltration of the upper lobe of the lung. Left-sided pleurisy bliterates the semilunar space where the stomach bulges upward, pneumonia produces no limitation of that space. Bronchial ration is less audible in pleuritic effusion than in pulmonary infil- n. The presence of rusty sputa and the rapid and cyclical course e symptomatic fever are indicative of pneumonia. Displacement e heart and other thoracic organs indicates pleurisy rather than monia.

e occurrence of *tumors* involving the lungs or the pleura occa-

sions great difficulty in diagnosis. Sometimes an exploratory puncture of the thorax greatly aids in differential diagnosis.

A circumscribed pleurisy in the neighborhood of the pericardium may lead to a suspicion of pericarditis, but its outline is generally more irregular than that of the pericardial enlargement; while the displacement of the cardiac apex and the presence of pericardial friction sounds and changes in the locomotion of the heart suffice to identify a pericardial effusion.

A circumscribed pleurisy in the splenic region may be mistaken for a tumor of the spleen. An enlarged spleen exhibits alternate displacements which correspond with the movements of respiration, while a circumscribed pleurisy presents nothing of the kind.

A moderate accumulation of liquid in the right thoracic cavity may be distinguished from *enlargement of the liver* by the fact that enlargement of that organ generally causes protrusion of its lower border below the ribs. When that border occupies its normal position an increase of dulness in the lower portion of the chest must be ascribed to pleurisy. If the upper limit of dulness be higher in front than behind, it is probably caused by a tumor or abscess in the liver. Hepatic enlargements of every kind exhibit movements in conformity with the respiratory excursions of the diaphragm, while pleuritic exudations are not thus affected. The intercostal spaces are distended by effusion, but remain uninfluenced by hepatic tumors, which often cause outward projection of the lower ribs. Hepatic disease is, also, frequently associated with symptoms of icterus and other evidences of biliary disease. Finally, the existence of sub-diaphragmatic abscess in the form of an accumulation of pus between the diaphragm and the liver, or the spleen, may sometimes lead to confusion with empyema. The history of these cases usually points to the previous occurrence of abscess or echinococci in the liver, or to suppurative peritonitis, caused by perforation of the gall-bladder, or stomach, or intestines, or to suppuration of the spleen, or to a para-nephritic inflammation outside of the peritoneal cavity.

It is well to remember in cases where the question arises as to the presence of fluid in the pleural cavity, or as to the character of such fluid, that an exploratory aspiration, under antiseptic precautions, will, without danger, give the desired information.

Empyema necessitatis can be distinguished from an abscess connected with *caries of the spinal vertebræ* by the presence of the physical signs of pleurisy and by the absence of symptoms indicating spinal disease. *Peripleuritic abscess*, characterized by the accumulation of pus outside of the costal pleura itself, is distinguished from empyema by the fact that the intercostal spaces are dilated only over the region occupied by the abscess. Forcible expiration and cough do not cause its universal enlargement; nor can its volume be reduced by pressure from without. After evacuation of its contents the finger readily reaches the base of the abscess, which it cannot do when an empyema is opened.

The *occurrence of pulsation in empyema* calls for a differential diagnosis between that disease and *thoracic aneurism*. The following rules have been laid down for the establishment of the distinction.

Aneurismal tumors generally appear upon the upper and anterior tion of the right thoracic wall; while pulsating empyema generally upies the lower portion of the left side of the chest. 2. An em- ma may be modified by pressure and by respiratory movements; an aneurism cannot be thus changed. 3. Aneurismal dulness on cussion is restricted to the limits of the tumor; but in empyema ness is generally diffused over the thorax. 4. Aneurismal mur- rs are generally audible; while the region of an empyema remains ent.

In order to ascertain with positive certainty the character of the usion in pleurisy, it is necessary to perform *exploratory puncture* of e pleural cavity. This may be easily performed with a large hypo- rmic syringe which has been thoroughly cleansed and disinfected. he operation should be performed by plunging the canula through the oracic wall, in one of the posterior intercostal spaces where dulness d other signs have indicated the presence of a liquid effusion. With e thumb and forefinger of the left hand placed upon two adjacent bs, the point of the hollow needle should be forced quickly through e tissues between the fingers, taking care to avoid the ribs; a syringe- l of the pleural contents may be then sucked out. If no fluid fol- ws the introduction of the needle the barrel of the syringe should unscrewed, and an effort be made with a fine probe to clear the nula. It may be necessary to withdraw the needle and to renew the tempt at another point. The trifling wound that is made should be osed with adhesive plaster. In this way it becomes possible to arrive a decision regarding the nature of the thoracic contents.

Prognosis.—The prospect of recovery in pleurisy depends upon the use of the disease and upon the character of the effusion. Those ses which are dependent upon malignant tumors, and upon chronic d malignant diseases, are characterized by a very unfavorable prog- sis; while dry pleurisy, unless it recur frequently at the apex of the gs, as a consequence of tuberculosis, is generally followed by re- very.

The prognosis in pleurisy will, then, depend largely upon the amount d character of the exudation. *Serous pleurisy* affords a favorable ognosis, except in those cases which are dependent upon tuberculosis. *mpyema* seldom recovers spontaneously; but the prognosis is com- ratively favorable when the character of the effusion has been recog- zed at an early period, and when appropriate treatment has been ployed. *Ichorous* and *hemorrhagic effusions* are dependent upon uses which render the prognosis very doubtful. The same thing is ue of effusions that contain tubercle-bacilli.

The occurrence of *excessive effusion* adds greatly to the danger of e patient through the embarrassment and displacement of the intra- oracic viscera, which may thus occasion great dyspnœa, and which o tends to perpetuate itself by compression of the lymph channels ough which absorption should be effected. As a general rule, the ger a pleuritic effusion persists the greater the danger to which it oses the patient. High fever and recurrent exacerbations add to the k. Though pleurisy occurs more frequently upon the left side of the

thorax than upon the right side, it is a well-known fact that right-sided pleurisy is more dangerous, on account of its frequent association with pulmonary tuberculosis.

TREATMENT.—*Dry pleurisy* requires treatment in bed, because, if the patient be allowed to remain on his feet, there is danger of a liquid effusion in addition to the original fibrinous exudation. Warm poultices should be applied to the affected side. Hypodermic injections of morphine and atropine may be given for the relief of pain and cough. If these measures do not sufficiently relieve, cups, either wet or dry, may be applied with advantage to the thoracic wall. In rheumatic cases, chloroform liniment will be found useful. Any considerable degree of fever requires the use of phenacetine or acetanilide.

Uncomplicated *serous pleurisy* may be treated in the same way; but if at the expiration of a fortnight no signs of absorption appear, it will be necessary to attempt the stimulation of that process. The bowels must be opened daily with gentle laxatives.

℞.—Pulv. glycyrrhiz. comp., ... ʒj-iv.
Daily.

℞.—Pil. rhei comp., no. i–iii, every night.

The amount of the urine must be observed, and the quantity of liquids consumed by the patient should not be allowed to exceed the urinary discharge, otherwise it will be difficult to reduce the effusion. It has been customary to adminster mercurials for the purpose of hastening the process of absorption, but, with the exception of a three-grain blue pill, once or twice a week, it is unnecessary to resort to such measures. Iodide of potassium may be given in doses of five to ten grains three times a day. Digitalis, in the form of infusion, with citrate of potassium, or nitrate of potassium, or acetate of potassium, may be given every two hours, daily. Bitartrate of potassium is also a useful remedy, especially if the bowels are inclined to constipation. Vegetable diuretics, such as squills, infusion of fresh parsley root, etc., may also be used in connection with saline diuretics and digitalis.

Vigorous patients may be treated advantageously by the use of cathartic remedies, since active purging such as occurs during a choleraic attack, has been known to rid one completely of a long-standing serous effusion. The best cathartics for this purpose are the compound infusion of senna, compound colocynth pills, compound jalap powder, and pills containing croton oil in drop doses.

The employment of diaphoresis through the agency of hot air or hot water baths is attended with considerable danger from dyspnœa. The employment of pilocarpine by daily hypodermic injection affords excellent results, though it is generally expedient to administer wine or whiskey, in order to prevent the depressing and nauseating influence of the drug. In like manner, salicylic acid or salicylate of sodium, in ten-grain doses every half-hour until a drachm has been taken every day, often produces excellent results; though, in consequence of the danger of cardiac depression, it is never safe to leave the administration of such remedies in the hands of inexperienced persons. In all cases a nutri-

and abundant diet should be furnished. Weakly and anæmic ns should also receive tonic medication.

℞.—Elix. calisay. ℥ss.
Every four hours.

℞.—Elix. gentian. et ferri ℥j.
Every four hours.

myss, butter-milk, and boiled milk may be given as freely as de-

ut, if at the end of four weeks the effusion gives no sign of reduc- or at an earlier period if its amount be sufficient to embarrass the t or the lungs, it will be necessary to resort to aspiration of the ral cavity. This may be easily accomplished by the aid of Potain's rator. The patient should be placed upon the healthy side, with shoulders elevated, in a position intermediate between lateral and al recumbency. The apparatus must be thoroughly cleansed and nfected; having exhausted the air from the flask by the use of the pump, the trochar-canula should be introduced quickly through the acic wall in one of the intercostal spaces, as low down as possible ween the axillary and the scapular lines. Care must be taken to d the liver or the spleen. The stop-cock between the canula and flask should then be opened, and the fluid will quickly flow through tube that connects the canula with the exhausted receiver. A few kes of the air-pump at intervals will suffice to maintain the partial ium that is necessary to promote the flow. When a sufficient unt has been thus evacuated the canula may be withdrawn, while skin around the tube is pinched up between the thumb and finger, rder to prevent the entrance of air into the pleural cavity as the in- ment leaves the wound. A piece of adhesive plaster should then pplied over the puncture. It is unnecessary to empty the cavity ts entire contents, for when the pressure has been largely relieved natural process of absorption generally suffices to accomplish the oval of the remaining fluid. Too hasty and too complete evacua- of the cavity is sometimes followed by œdema of the lungs. The rrence of pain or violent cough, or the transformation of a serous sion into a bloody liquid by hemorrhage, or the intercurrence of cope during the course of the operation, should be accepted as indi- ons for its termination. A fatal result sometimes follows syncope, n dependent upon cerebral anæmia through excessive evacuation ie pleural cavity. Under such circumstances the patient's head ld be depressed; alcoholic stimulants should be administered, and ay be made to inhale the vapor of ammonia. Sometimes an un- rable result is due to the sudden liberation of a thrombus, produc- embolism in the lungs, or in the brain, and thus unexpectedly inating life. Death under these circumstances has been known to r in consequence of hemorrhage into a pulmonary cavity which had suddenly relieved from pressure by the withdrawal of the pleuritic ion.

nder favorable circumstances recovery may speedily follow aspira- ; but, sometimes, the fluid reaccumulates and requires a repetition

of the operation. If carelessly performed, and, sometimes, even in spite of the utmost precaution, a serous liquid may become transformed into a purulent accumulation.

Empyema requires evacuation of the purulent contents of the pleural cavity as soon as possible after the discovery of their character; delay only increases the exhaustion of the patient, and adds to the danger. It is useless to wait for the tardy and ineffectual operation of internal remedies. The aid of the surgeon must be invoked, and the evacuation of the pleura must be effected by incision and resection of one or more ribs. As regards the operation of aspiration, age forms no contra-indication. Very young children and old people may be successfully treated in this way.

The operation requires complete anæsthesia. The most convenient locality for incision is in the axillary region, between the fifth and eighth ribs After removal of the resected portion of the rib, a free opening must be made for the evacuation of pus. The pleural cavity must be emptied and irrigated with a tepid solution of salicylic acid or boric acid. Carbolic acid and corrosive sublimate solutions must now be employed, in consequence of the danger of acute poisoning which accompanies such use of those disinfectants. Proper provision for drainage must be made, and at every dressing thorough irrigation and drainage must be secured. Recovery soon follows, unless tuberculosis prevents the healing process; in which case a permanent fistula may become established, which will require surgical treatment. Sometimes *encysted empyema* is discovered which necessitates the opening of several cavities.

Unfavorable symptoms rarely follow the above-described operation; but sometimes syncope or convulsions or paralytic symptoms have been observed. These phenomena may be the result of embolic processes suddenly excited by the operation. Similar results have been known to follow simple irrigation of the pleural cavity at some time after the original operation.

The existence of a *thoracic fistula* or the development of an *empyema necessitatis*, or the rupture of an empyema through the lungs, all require the operation by incision and resection of the ribs.

Hemorrhagic pleurisy, being dependent upon constitutional dyscrasia, should not be treated surgically unless the danger of death from excessive effusion be imminent. Pressure should then be relieved by aspiration.

Putrid pleurisy requires the same treatment that is required in empyema. Since it is generally connected with the occurrence of pulmonary gangrene, it will be necessary to combine with the operation by incision the treatment that is useful in cases of gangrene.

Pleuritic effusion occurring in connection with *pulmonary tuberculosis* may be treated precisely like other forms of pleurisy.

The occurrence of *thoracic retraction* after the evacuation of the pleural cavity requires the employment of gymnastic methods for the expansion of the contracted lung and development of the retracted thorax. This must be accomplished by frequent repetition, many times a day, of the act of deep inspiration, accompanied by elevation of the

and shoulder on the side of the deformity. This gives better lts than respiration of compressed air.

Pneumothorax—Hydro-pneumothorax.

Pneumothorax signifies an accumulation of air in the pleural cavity; as this is usually accompanied by the presence of a certain amount fluid effusion, the term hydro-pneumothorax is frequently employed. pus or blood be associated with air, the terms pyo- and hæmo-pneu-thorax are convenient to signify the fact.

Etiology. Sometimes liquid effusion precedes the entrance of air to the pleural cavity. The reverse may be the case. Sometimes th air and fluid enter simultaneously, as when a pulmonary cavity ptures and discharges its contents within the pleura. Sometimes e entire cavity of the pleura is occupied by air and water; in certain ses they are contained within a space that is circumscribed by adhe-ons, constituting *circumscribed* or *encysted hydro-pneumothorax*. A ontaneous generation of gas within the pleura has been asserted, but is doubtful, though it sometimes happens that no opening can be scovered after death through which they could have entered the space.

Pneumothorax occurs most frequently during the course of pulmonary seases, especially when they are of a *tubercular character*. Caseous posits immediately beneath the pleural surface may occasion the rmation of cavities which rupture into the pleural space, and permit e entrance of air. This can only occur when rupture precedes the rmation of adhesions between the costal and visceral pleura in the gion of an impending perforation. The accident rarely happens at e apex of the lungs, but usually along the lower border of the upper be, or near the upper border of the middle lobe. It is generally served in an antero-lateral portion of the lungs, near the second or ird intercostal space.

Besides pulmonary tuberculosis, other *ulcerative processes* which may volve the lungs can occasion the occurrence of perforation and the oduction of pneumothorax. Accordingly it is not uncommon in ses of *pulmonary abscess* or *gangrene of the lungs*, or as a conse-ence of ulceration excited by *echinococcus* parasites which have nd their way into the lungs. In like manner, *wounds* that either rectly or indirectly occasion perforation of the lungs, may produce eumothorax. Fractures of the ribs may cause laceration of the lmonary pleura and consequent entrance of air into the pleural ace.

Excessive muscular exertion, such as accompanies violent cough, tably in whooping-cough, and other sudden efforts, have been known occasion rupture and pneumothorax. Special danger attends such ertions on the part of individuals who suffer with *emphysema* of the gs, by which the superficial air cells have been dilated and atrophied nost to the point of spontaneous rupture, an event which, sometimes, ually takes place. In like manner *peripheral bronchiectasis* may come the point of communication between the air passages and the ural cavity.

Rupture of an empyema into the lungs, or into any other cavity that is filled with air, may be the occasion of admission of air into the pleura. This event, however, does not necessarily follow a rupture through the lungs, because a valvular opening may be formed which will effectually prevent the entrance of air. It sometimes happens that *suppurating bronchial glands* open simultaneously into the bronchi and into the pleura, producing pyo-pneumothorax. In like manner, *abscesses* and *cancerous degenerations* of the œsophagus, or rupture of that canal, may cause the admission of air. It is often possible for *ulcerative processes* to effect a communication between the *stomach* or *intestine* and the *pleura*, with consequent production of pneumothorax. In the vast majority of cases, however, pneumothorax is directly dependent upon pulmonary and pleural diseases.

Pathological Anatomy. *Pneumothorax* frequently occasions a perceptible distention of the affected side; and, after death, puncture will be followed by the escape, with a hissing sound, of gas, if its tension be greater than that of the surrounding atmosphere. The escaping stream may be either odorless, or it may liberate an offensive stench which is due to the presence of sulphuretted hydrogen. Simple pneumothorax must necessarily be a very rare event, since the admission of air laden with germs which excite inflammation must be followed by exudation within the pleural sac. This may be either of a serous, purulent, hemorrhagic, or ichorus character, according to the nature and intensity of the exciting causes. If the gaseous contents of the cavity should be subsequently absorbed, the remaining fluid would occasion the ordinary symptoms and signs of pleurisy with effusion.

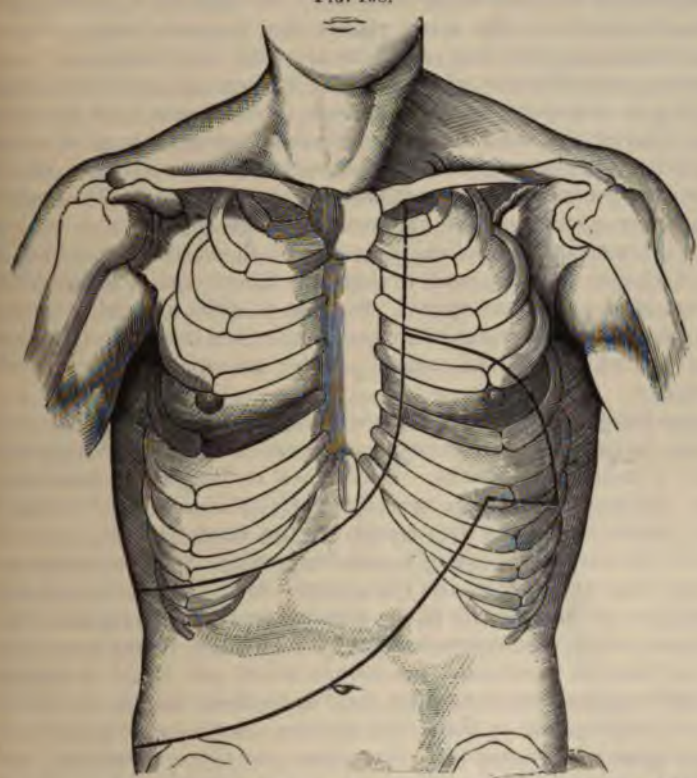
When the opening through which air has entered the pleura is free and unobstructed, the fact is indicated by the term *patent pneumothorax*. When the orifice possesses a valvular character, it occasions *valvular pneumothorax*. In some cases air becomes thus imprisoned and subjected to a considerable increase of pressure when the valvular opening permits access of air only during the act of inspiration. In this way the pleural cavity may become greatly distended, and there will be corresponding displacement and compression of the thoracic organs and of the diaphragm with the subjacent viscera. (Fig. 108.) *Pneumothorax by occlusion* signifies a condition in which there is no apparent communication between the air in the pleural cavity and the external atmosphere. Transitional forms between these three varieties may exist, *e.g.*, a valvular pneumothorax may become transformed into a condition of either patency or occlusion.

The existence of pneumothorax occasions collapse of the lung and its compression against the mediastinum or the spinal column. It is sometimes difficult, if not impossible, to discover the point of perforation in consequence of its obliteration by inflammatory exudation. Sometimes inflation of the lung under water, will reveal the opening by the escape of air-bubbles at the point of rupture.

Symptoms. The affected side exhibits considerable distention. The intercostal spaces disappear, or become actually prominent. Respiratory movements upon the same side are diminished or absent. The heart is crowded to the right when the left side of the thorax is filled

h air, and it is displaced to the left when the right side is similarly tended. In like manner, the liver or the spleen may be much pressed. The patient lies by preference upon the diseased side. any patients are obliged to maintain the sitting posture. Respiration frequently hurried and laborious. A certain amount of cyanosis is o perceptible. Vocal fremitus is diminished or entirely suppressed, less preëxisting pleuritic adhesions furnish local means of conduc- n to the thoracic wall. At such points the vocal fremitus may be rceived even more clearly than under normal conditions. The sense resistance on pressure over the thorax is increased.

FIG. 108.



Displacement of mediastinum, heart, and liver from pneumothorax of the right side. (WEIL.)

Sometimes when the pleural cavity contains both air and water, a nse of fluctuation may be experienced in the intercostal spaces over e liquid accumulation. Sometimes on shaking the patient, a distinct lashing (succussion sound) can be heard, as if water were shaken in bottle. In certain cases a sound like that of dropping water can be ard after such agitation or change of position. It is supposed to be used by drops of liquid trickling down from bands of exudation in e upper part of the cavity.

The sounds which are evoked by *percussion* vary according to the condition of the thorax. In cases of patent pneumothorax the percussion sound is very loud and tympanitic, and is accompanied by a metallic resonance. In cases of valvular pneumothorax, or of pneumothorax by occlusion, there is great distention of the chest, and the percussion sound loses its tympanitic quality and becomes dull. This is supposed to be caused by interference between the sound waves that originate in the air of the cavity and those that have their origin in the vibrations of the thoracic wall. When the air in the pleural cavity communicates freely with the external atmosphere, a short and sharp percussion stroke is followed by the "cracked-pot sound." Changes in the pitch of the percussion sound may be observed when the mouth is open or closed, for the same reason that produces such changes in the pulmonary cavities that communicate with the bronchi.

Hydro-pneumothorax gives a great variety of percussion sounds, according to the position of the patient, in consequence of the change in the level of the fluid which accompanies every change of attitude. The pitch of the percussion note also varies according to the posture of the patient, because in the erect position the fluid contents accumulate in the lower portion of the sac, causing depression of the diaphragm and an increase in the vertical diameter of the space that is filled with air. A change in pitch must necessarily follow such a modification in the form of the resonant cavity. Similar modifications of pitch follow every considerable increase or diminution in the amount of fluid exudation by which the dimensions of the air space are subjected to variation.

Auscultation discovers great variability in the respiratory sounds that can be heard. Respiratory sounds are very much weakened, and acquire a metallic resonance. Sometimes an amphoric sound can be heard. All such sounds are most distinctly audible in the interscapular space, where the lungs lie nearest to the thoracic wall. Bronchial râles, if present, also acquire a metallic quality, in consequence of the fact that all sounds which are transmitted from the respiratory organs through the air-filled cavity of the pleura excite, within its space, aërial vibrations which are characterized by a metallic resonance. Similar metallic qualities accompany the sounds which are heard in connection with hydro-pneumothorax, since they have their origin in the vibrations which originate in the air-filled space above the level of the fluid. Bronchophony also exhibits the same metallic resonance, though enfeebled, as it is in pleurisy.

The sudden occurrence of pneumothorax in cases with previously healthy lungs and pleura is attended with very severe symptoms of distress. Consciousness may remain unimpaired. There is great complaint of want of breath, and of severe pain in the lower part of the chest, as a consequence of excessive distention of the thoracic cavity. The pulse is accelerated; the heart may be considerably displaced, and its sounds have acquired a metallic quality in consequence of the neighborhood of a resonant cavity in the pleura. The peripheral veins give indications of obstruction in the way of the return of blood to the heart. After a time the extremities may, consequently, become oedema-

while venous hyperæmia in the brain occasions sensations of dizzi-
pressure in the head, ringing in the ears, and other symptoms of
ral engorgement. The liver or the spleen may be crowded down-
by depression of the diaphragm, so that they can be felt below
ort ribs. The renal secretion is diminished, and sometimes con-
traces of albumin. General subcutaneous emphysema may be
oped if air finds its way into the connective tissue of the lungs
ediastinum.

eumothorax may continue for several weeks or months; some-
death follows within a few minutes from asphyxia. If life is not
uickly terminated, the symptoms of dyspnœa and great prostra-
ill remain prominent. In cases of hydro-pneumothorax life has
prolonged for many years; but if the effusion should become
ent death is very likely to follow amyloid degeneration of the
organs. Recovery sometimes occurs, even after pulmonary gan-
or tuberculosis. Sometimes the air is absorbed from the pleural
y, and the disease persists in the form of pleurisy with effusion.

AGNOSIS. In uncomplicated cases of pneumothorax or hydro-
mothorax the diagnosis is seldom difficult. The nature of the
on may be readily determined by an exploratory puncture. But,
the contents of the pleural cavity are circumscribed by adhesions,
ay be difficult to decide between hydro-pneumothorax and large
onary cavities, or diaphragmatic hernia, or gaseous distention of
tomach, or sub-phrenic abscess into which air has been admitted.

hen a *pulmonary cavity* exists the intercostal spaces are depressed,
in pneumothorax they are distended and prominent. Vocal fre-
s is increased over a pulmonary cavity, while it is diminished in
mothorax. The existence of succussion sounds favors the diagnosis
dro-pneumothorax.

iaphragmatic hernia has been known to cause the passage of the
ach and a part of the colon into the thoracic cavity, with consequent
opment of the physical signs of pneumothorax.

aseous distention of the stomach may give rise to the physical
of pneumothorax; but the history of the case and the rapid dis-
arance of symptoms after evacuation of the stomach will clear up
liagnosis.

erforation of the stomach or intestines by ulceration may produce
hrenic pyo-pneumothorax; but the previous history of the case,
the absence of pulmonary symptoms, will generally remove doubt.
fecal odor follows exploratory puncture, the case belongs to the
diaphragmatic class.

ROGNOSIS. The prognosis is always very grave; especially is this
of any sudden and unexpected cases which are liable to run a rapid
fatal course. Valvular pneumothorax is the most dangerous form
e disease, because of the excessive distention of the pleural cavity,
consequent displacement of thoracic viscera, which it occasions.
predisposing causes of pneumothorax are often such as to render
ery doubtful or impossible.

EATMENT. The symptoms of collapse and asphyxia, which fre-
ly follow the sudden development of pneumothorax, must be

opposed by the administration of alcoholic stimulants, by the hypodermic injection of ether, and the use of camphor, valerianate of ammonia, or the aromatic spirits of ammonia. Dry cups, mustard plasters, or other cutaneous irritants may be applied externally. Dyspnœa which is dependent upon nervous excitement, in consequence of the sudden advent of pneumothorax, may be somewhat relieved by measures which tranquillize the patient. Persistent difficulty of breathing may be relieved by the cautious use of small doses of morphine and atropine hypodermically. Great displacement of the thoracic viscera may be relieved by aspiration. This operation is most successful in pneumothorax by occlusion, since the valvular form of the disease may readily be reproduced. When the tension of the air within the pleural cavity exceeds that of the external atmosphere it will readily escape through an ordinary trocar, the external orifice of which should be covered with antiseptic cotton, in order to prevent the admission of air into the thoracic cavity through accidental reversal of the current. The puncture should be immediately closed with sticking-plaster as soon as the trocar is withdrawn. In cases of pneumothorax by occlusion the ordinary aspiration apparatus should be used. If the liquid contents of the pleural sac are purulent, the ordinary treatment of empyema by incision will be required. Serous effusions need not be removed, unless their quantity be sufficient to endanger life. The same rules apply when hydro-pneumothorax occurs in connection with pulmonary tuberculosis.

Hydrothorax.

Hydrothorax is an accumulation of dropsical fluid in the pleural cavity.

Etiology. *Hydrothorax* is almost invariably associated with other symptoms of general dropsy which depend upon a common cause. This usually lies in a diseased condition of the respiratory apparatus or of the heart. The existence of *tumors*, etc., which compress the superior venæ cavæ may lead to thoracic dropsy. *Local changes* in the walls *of the capillary bloodvessels*, which occur as a secondary consequence of certain diseases, notably scarlet fever; impoverishment of the blood in Bright's disease, dysentery, chronic diarrhœa, or leukæmia; and cachectic conditions caused by cancer, malaria, or syphilis, are common causes of dropsy. A minor degree of hydrothorax is sometimes observed as a consequence of *lingering death* accompanied by symptoms of interference with the circulation. It has also been observed in certain rare cases of *obstruction of the thoracic duct.*

Pathological Anatomy. *Hydrothorax* is generally observed in both pleural cavities; though, sometimes, as a consequence of lying for a long time upon the same side of the body, the dependent cavity contains a larger amount of liquid than is found in the other. The transudate is a clear, limpid, greenish-yellow, or amber-colored fluid, sometimes containing cholesterine and a few endothelial cells. Its reaction is alkaline, and the specific gravity is about 1009 to 1012. A specific gravity above 1015 usually indicates an inflammatory exudation.

The pleural surface frequently appears white and œdematous. The

s are more or less displaced and compressed; but they can gener- be inflated, unless they have been long subjected to pressure, or d down by adhesions. The heart, the diaphragm, the liver, and pleen may also be displaced by the accumulated liquid.

YMPTOMS AND DIAGNOSIS. The subjective symptoms are occa- d by compression and displacement of the thoracic viscera, ioning difficulty of respiration, asthmatic paroxysms, cyanosis, and blement of the pulse.

spection frequently indicates distention of the thorax, though the nces of downward pressure are usually less than in cases of pleu- with effusion. The movements of respiration are diminished.

alpation. Vocal fremitus is diminished in those portions of the x which are occupied by fluid; and the sense of resistance to ure is considerably increased.

ercussion indicates dulness, and the level of dulness varies according e position of the patient, unless previous adhesions of the pleural ces interfere with the free movement of the transudate. Unlike najority of cases of pleurisy with effusion, a dropsical transudation lly occupies both sides of the chest, unless one pleural cavity has previously obliterated by inflammation and adhesion.

gophony is sometimes audible along the upper surface of the fluid.

ultation further indicates the absence of respiratory murmurs. chial breathing may be audible in the interscapular spaces where ompressed lungs are situated.

doubtful cases an exploratory puncture may throw light upon the

ROGNOSIS. The prognosis depends upon the predisposing cause of sical transudation.

REATMENT. The treatment of hydrothorax is intimately connected the therapeutical management of the underlying disease. This lly requires the exhibition of diuretics, purgatives, and diaphoretics, her with tonics and a proper dietetic regimen. If the fluid accu- te in such a quantity as to interfere with the function of the cic organs, it will be necessary to aspirate the pleural cavities, as ses of pleurisy with serous effusion.

Hæmothorax and Chylothorax.

æmothorax consists in an accumulation of blood within the pleural y, and it may occur as a consequence of wounds, injuries, or hem- ge from aneurisms or bleeding vessels within the thorax. *Chylo- x* has been observed as a consequence of wounds or ruptures of the cic duct. Such cases are almost inevitably fatal, yet recovery has known to occur. The milky fluid which occupies the pleural y must not be confounded with pus or with fatty exudations which times occur in cancerous diseases of the pleura. The history of ase, and microscopical examination of the fluid, will readily deter- the diagnosis.

Cancer of the Pleura—Carcinoma Pleuræ.

Cancerous and sarcomatous diseases in other localities of the body may be followed by a *secondary affection of the pleuræ*. All varieties of malignant disease may also occur, and may originate affections of the pleural membranes. Sometimes the tumors are very numerous and exceedingly small, almost like miliary tubercles. In other cases they reach an enormous size, and occupy the entire cavity of the pleura to the great disadvantage of all the thoracic viscera. Their development is frequently accompanied by cancerous pleurisy, with an effusion which may be either dropsical or inflammatory, and may exhibit all the varieties of effusion that are dependent upon pleuritic inflammation. The symptoms are at first exceedingly obscure, and they vary in kind and in intensity according to the locality and the extent of the cancerous growth. It is often impossible to arrive at anything more certain than an inferential diagnosis as to the nature of the disease. The concurrence of malignant disease in other parts of the body, and the course of the local changes, often afford the principal data for a conclusion.

CHAPTER VII.

DISEASES OF THE MEDIASTINUM.

Mediastinal Inflammation—Mediastinitis.

Inflammation of the mediastinal connective tissue is of rare occurrence. It may be either acute or chronic, and may occupy either the anterior or the posterior portion of the mediastinal space. The *acute form* frequently results in suppuration, while the *chronic variety* often occasions the development of indurated masses, which may considerably interfere with the adjacent organs. The acute form of the disease may be of *traumatic origin*, or may be dependent upon *rheumatism*, or it may be the result of an *extension of the inflammatory process* from neighboring territories and organs. *Infective diseases* and *pyæmia* sometimes occasion the development of mediastinal abscess. The chronic form of the disease is frequently dependent upon *chronic pulmonary disease*.

Symptoms and Diagnosis. *Acute mediastinitis* is characterized by the general symptoms of acute inflammation, by local pain and tenderness under the sternum, accompanied by cough and intra-thoracic distress. The extension of suppuration will be indicated by increasing dulness on percussion, either in front or behind, according to the location of the abscess. Pus may escape externally, or it may find its way into any one of the intra-thoracic cavities.

The indurations which result from *chronic mediastinitis* may produce compression of the large vessels within the thorax, and, by

r adhesion with the walls of the œsophagus and subsequent con-tion, they may produce diverticula or pouches connected with that sage.

PROGNOSIS AND TREATMENT. The prognosis is not very favorable. ath sometimes occurs suddenly, or as a consequence of chronic inter-nce with the thoracic organs. The treatment must be conducted general principles.

Mediastinal Hemorrhage.

Hemorrhage into the mediastinal connective tissue is sometimes erved in connection with rupture of the large intra-thoracic blood-sels, aneurismal tumors, etc., or as a consequence of wounds or er injuries.

Mediastinal Tumors.

PATHOLOGICAL ANATOMY. *Carcinoma, sarcoma, lipoma, fibroma, eoma, dermoid cysts*, and other growths may become developed in mediastinal spaces. In many cases such neoplasms originate in the diastinal lymph glands and connective tissue. In other cases they se in the organs that lie within the mediastinum, or in other thoracic cera, which become diseased and extend their malignant proliferation o the mediastinal spaces.

ETIOLOGY. The disease is more frequent among men than among men, and generally occurs during the period of active adult life. bercular tumors are generally associated with the manifestation of erculosis in other parts of the body. Leukæmia and pseudo-leukæmia sometimes accompanied by the development of tumors in the medi-inum, as well as elsewhere. Syphilis exerts very little influence on the development of mediastinal growths, unless the inner surface the sternum is first involved.

SYMPTOMS. The principal symptoms have their origin in the com-ession of neighboring organs, when tumors have reached a sufficient e to exert such pressure. By the growth of large tumors in the an-ior mediastinal space, the sternum and the costal cartilages may be shed outward, and the characteristic appearances of a tumor then come visible. Sometimes pulsation may be distinguished, as a con-quence of impulses derived from the large arterial trunks. Obviously, e area of dulness will be enlarged in proportion to the size of the owth. Tumors in the posterior mediastinal space may produce per-ptible dulness along the spinal column. Displacements of the heart d lungs produce the usual symptoms by which the dislocation of those gans is recognized. The trachea, the bronchi, the œsophagus, and e pneumogastric nerve may likewise give evidence of compression. e innominate veins, the venæ cavæ, and the azygos veins, may thus dergo constriction, or occlusion, with the production of consequent lema in the face, neck, and upper extremities. The superficial veins on the thorax also exhibit signs of distention.

The respiratory apparatus often experiences great interference from

the development of mediastinal tumors. One or more *bronchi*, or the *trachea* itself, may be compressed to a degree that interferes with respiration and articulation. Paroxysms of dyspnœa, asthmatic symptoms, and stridulous breathing are of frequent occurrence. Laryngoscopic examination often reveals paretic or paralytic conditions of the laryngeal muscles, caused by *pressure upon the recurrent nerve*. The voice, in such cases, may be rendered hoarse and whispering, or it may be completely abolished. For the same reason there is danger of the intrusion of foreign substances into the larynx and trachea during the act of swallowing. The movements of the heart and of the œsophagus and stomach may be greatly obstructed or perverted by *pressure upon the pneumogastric nerve;* hence the occurrence of œsophageal spasm, hiccough, and vomiting, which are sometimes observed. *Pressure upon the sympathetic* nerve trunk produces changes in the pupil of the eye, so that one pupil may be contracted, while the other is dilated. Pain is sometimes observed in the upper extremities, or in the spinal column; it is, usually, paroxysmal and often intense. *Cough* is, generally, very severe, though unaccompanied by any considerable amount of expectoration, unless local suppuration occur, followed by subsequent rupture of an abscess into a bronchus or into the trachea, when a copious purulent discharge may be witnessed. There is great complaint of sleeplessness; and, sometimes, the symptoms of *cerebral hyperæmia* are evident in the form of dizziness, noises in the ears, flashes of light before the eyes, etc.

The *duration of the disease* depends upon the nature of the tumor and upon the rapidity of its development. Sometimes the disease is terminated within a few weeks; in other cases it persists for several years. *Death* occurs as a consequence of exhaustion, or from compression of the respiratory or circulatory organs, or from obstruction of the œsophagus by which the swallowing of fluid is rendered impossible. It may also result from intercurrent diseases.

Diagnosis. Small tumors which do not exert pressure upon the neighboring parts may escape recognition. In some cases the existence of the mediastinal tumor is a matter of inference dependent upon symptoms in distant organs (*e. g.*, laryngeal paralysis, pupillary differences, etc.), after exclusion of the symptoms of aneurism, pericarditis, circumscribed pleurisy, and mediastinal abscess. The existence of malignant tumors in other parts of the body favors the diagnosis of similar growths within the mediastinal cavity.

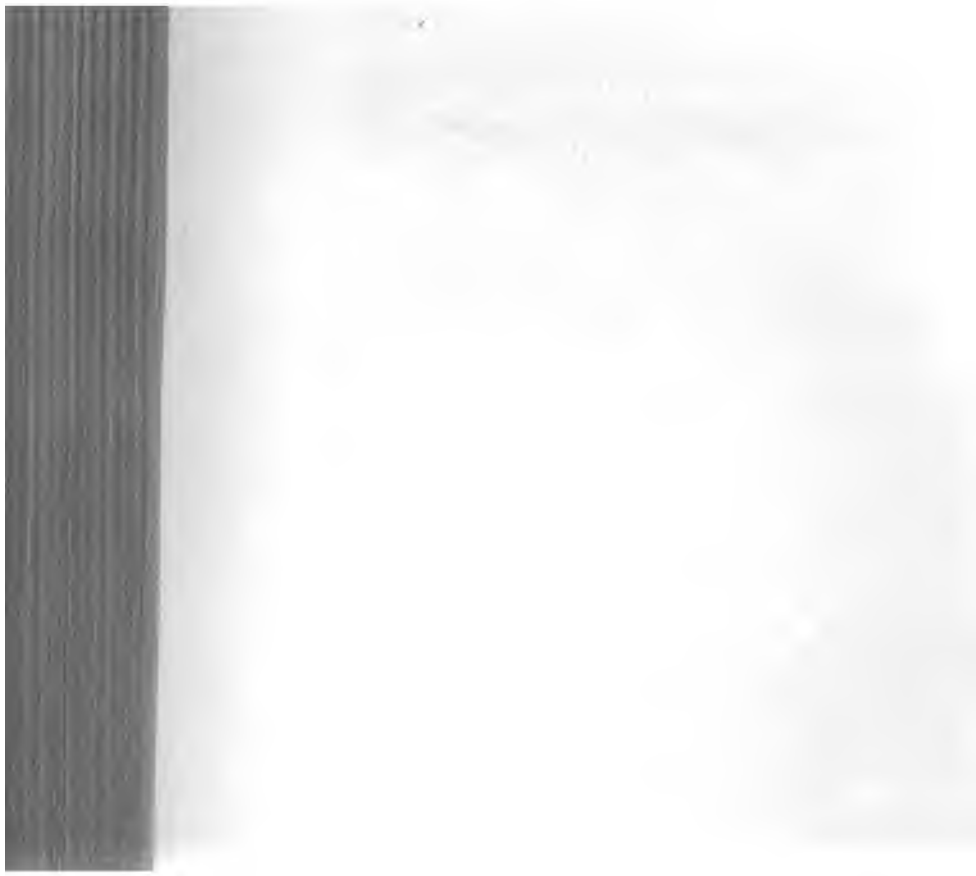
Prognosis. The prognosis is exceedingly unfavorable, especially when the tumor is of a malignant character.

Treatment. The treatment must necessarily be entirely symptomatic. Iodide of potassium and mercurial preparations are of very little value. Tuberculosis of the glands may be treated with cod-liver oil and the syrup of the iodide of iron. Sarcomatous growths, with leukæmic and pseudo-leukæmic tumors, are temporarily benefited by the administration of arsenic.

CHAPTER VIII.

DISEASES OF THE THYMUS GLAND.

NCE the functions of the thymus gland are unknown, its diseases ss comparatively little clinical importance. *Hypertrophy* of the us gland may theoretically interfere with the processes of respira- ınd circulation; but obviously such hypertrophy cannot be distin- ed from other enlargements in the mediastinal space. *Hemorrhage* occur into the substance of the gland in hemorrhagic diseases. *esses* and *tumors* may also become developed in the gland, under ı circumstances the symptoms of mediastinal abscess or of medi- al tumor will be observed.



PART VI.

DISEASES OF THE ORGANS OF CIRCULATION.

DISEASES OF THE CIRCULATORY APPARATUS.

CHAPTER I.

ENDOCARDIAL DISEASES.

Ulcerative Endocarditis—Endocarditis Ulcerosa.

ıOLOGY. *Ulcerative endocarditis* is an inflammation of the endo-
ım, usually manifested upon the valves of the left side of the heart
the line of contact of their segments when closed by the action of
'gan. The *disease has its origin* in the activity of certain micro-
ısms which find their way through the blood into the cavities of
ɛart during the course of various infective diseases. The entrance
ɛse pathogenic organisms may be generally traced to an external
l or to a remote septic process, such as may be discovered in the
e organs during puerperal fever. It may also become developed
complication in the course of many infective diseases, such as
t fever, diphtheria, typhoid fever, pneumonia, empyema, rheuma-
and suppurative inflammations involving the genito-urinary
s. It has been observed that the disease occurs more frequently
ınection with epidemics of infective disease than when they are not
ɛnt in the community.

ɛre are, however, cases in which it is impossible to trace a connec-
etween the endocardial disease and any prevailing source of infec-
Of these cases, some no doubt originate in local processes that
escaped observation, such as may exist in the nasal passages.
cases, however, may be caused by direct infection from without
gh the medium of the respiratory mucous membranes or through
ımentary canal. The disease is observed more frequently among
es than among males, by reason of the special liability of the
e to puerperal infection.

THOLOGICAL ANATOMY. *Ulcerative endocarditis* is observed more
ɛntly upon the left side of the heart than upon the right. It
y involves the substance of the valves, though it is occasionally

developed upon the parietal endocardium. The inflammatory process occurs usually upon that side of the valve that is directed against the blood current as it passes through the cavities of the heart. In the earliest stage of the disease there is a thin layer of exudation upon the endocardial membrane. If this be stripped off, a roughened surface, denuded of endothelium and surrounded by a reddened border, becomes visible. Later in the course of the disease the ulcerative process becomes more conspicuous. The neighborhood of the ulcer is infiltrated with the products of inflammation, accompanied by an abundant proliferation of pyogenic staphylococci and streptococci, with various other bacterial parasites, which, however, are not of a specific character, but are commonly observed in the course of septic inflammations. The adjacent tissues after a time may undergo the various changes that are produced by contraction, or by degenerations of a fatty or calcareous character.

As a consequence of ulceration involving one of the surfaces of a valve, the weakened structure beneath the ulcer may bulge under the pressure of the blood, and thus may be formed a valvular aneurism. Upon the mitral valve, or the tricuspid valve, such aneurisms may attain to considerable size, and their rupture will occasion an insufficiency of the ulcerated valvular curtain. Insufficiency of these valves may also occur as a consequence of the destruction of their papillary muscles and chordæ tendineæ during the progress of an endocardial ulceration.

The endocardial wall is sometimes infected by contact with an ulcerated valvular surface, and may then become the seat of an extensive ulcer, which, if located upon the septum between the ventricles or between the auricles, may open a communication between the cavities upon opposite sides of the heart.

As a consequence of the passage of the products of ulceration into the blood current, the course of the disease is complicated by the transfer of embolic masses from the heart into all parts of the body. Conveyed by the nutrient arteries of the organ, they obstruct the cardiac circulation; and by their infectious character, they originate suppurative processes within the substance of the heart, as well as in any or all of the other organs of the body. In this way the disease becomes complicated with the greatest variety of secondary disorders. The blood, moreover, undergoes the changes that characterize its dissolution, and the capillary vessels lose their capacity for retaining their contents, so that hemorrhages are of frequent occurrence in the skin, or upon the mucous and serous membranes, and upon the retina. Erythematous and roseolous eruptions and minute capillary embolisms are also sometimes visible upon the surface of the body. The spleen is usually enlarged and softened, as happens in other infective diseases. As a consequence of the high grade of fever that occurs, the muscular tissues, especially in the heart, undergo fatty or waxy degeneration. Cloudy swelling and granular degeneration of the cellular elements is commonly observed in all the organs.

Symptoms. As a consequence of the numerous complications that may occur in connection with acute ulcerative endocarditis, the symp-

s of the disease may exhibit a great variety. Sometimes the attack troduced with symptoms that remind one of Asiatic cholera, and h may speedily occur in a state of collapse. In other cases jaun- is present, which appears to be caused by dissolution of the red uscles of the blood and the transformation of their pigment into bile ment, which discolors the skin. Three principal forms, however, recognized.

. *The typhoid form.* In many cases the course of the fever and the eral appearance of the patient closely resemble the physiognomy of hoid fever. The fever is continuous; pulse and respiration are ewhat quickened; the abdomen is distended and tympanitic; the en is enlarged; rose spots appear upon the skin; the patient lies state of indifference, or may exhibit the symptoms of mild delirium; eyes are partly closed; the tongue is dry, brown, red at the tip edges, and may become fissured and bleeding. There is diarrhœa; stools sometimes contain blood; the urine is high colored, scanty, even albuminous. Endocardial murmurs are not always present, their absence renders the diagnosis still more difficult, especially hey are sometimes present in typhoid fever. The resemblance be- en the two diseases, in short, is so great, that it may be impossible a time to establish a positive diagnosis. The course of the disease y sometimes, however, throw light upon its nature through the elopment of embolic processes upon the skin or in the retina. taneous embolisms may be recognized under the form of minute aneous hemorrhages surrounding a clear, yellow centre that is upied by the embolic nucleus. Similar extravasations may be discov- d upon the mucous membrane lining the oral cavity. Various erup- ns that resemble the exanthems of measles, scarlet fever, erythema, sipelas, pemphigus, and pustular diseases may occur, and may some- es become the starting-point of gangrenous processes involving the n.

As a consequence of the extension of the embolic process to the s, an extravasation of blood may be observed beneath the conjunc- a or into the substance of the retina. Occasionally the whole eye y become involved by a universal purulent inflammation.

In the acute form of the disease, death may occur within a few days; acute cases may linger for a number of weeks, and the chronic form y endure for many months. The symptoms that precede death may those which characterize general infection of the system, or they y be those of heart failure, or of pericardial inflammation. Death y be the consequence of pulmonary or pleural complications, or life y terminate with symptoms of acute meningeal or cerebral dis- e.

2. *The intermittent form.* In this variety of the disease, the febrile ement closely resembles that of an intermittent malarial fever, etimes assuming the quotidian, the tertian, or even the quartan type. ere is great pallor, loss of appetite, and debility. The cardiac signs y be either entirely absent, or of a character that might be explained the anæmic condition of the patient. In such cases the utterly ative result of treatment with quinine should arouse suspicion of the

true nature of the disease. The occurrence of embolic phenomena in connection with other organs, and the development of cardiac murmurs with other evidences of change in the structure of the heart, will assist the diagnosis. As the disease progresses the fever tends to become more continuous, and may finally pass into a typhoid form, with a fatal result like what has been already described. The duration of the disease may reach many weeks or months before death occurs.

3. In the *third form* of the disease the cardiac disorder is often quite thrown into the shade by the extent and severity of the morbid phenomena that are manifested in organs remote from the original centre of disease. In certain cases there is only complaint of such palpitation and weakness as is common in cases of ordinary anæmia. The physical signs are also such as usually correspond with that condition; this negative condition may, however, undergo speedy transformation by the development of murmurs and changes that indicate a rapid extension of an ulcerative process involving the valvular structures of the heart.

In other cases a purulent inflammation involving the serous cavities of the thorax or abdomen may by its course and symptoms mask the phenomena that are connected with the endocardial disease in which it had its origin. In like manner acute pneumonia, cerebro-spinal inflammation, purulent disorganization of the joints, and other septic processes, may originate in, and obscure the course of, ulcerative endocarditis. Embolic obstruction of the cerebral vessels sometimes occurs with the production either of hemiplegic symptoms or of local paralyses involving one or more of the cranial nerves. Psychical disturbances, to say nothing of the delirium that may accompany fever, have also been observed.

Diagnosis. The preceding considerations sufficiently indicate the difficulties that attend the diagnosis of ulcerative endocarditis. In doubtful cases microscopical examination of the stools, or of blood drawn from the rose spots of fever, by the discovery of the pathogenic bacilli of typhoid fever, may serve to distinguish that disease from the endocardial inflammation.

Prognosis. The disease is almost invariably fatal. Eichhorst reports only one recovery in the course of his extensive experience.

Treatment. The treatment of the disease must be largely symptomatic, and in view of its great fatality cannot be very successful. The strength of the patient must be sustained by an appropriate diet, like that recommended for patients suffering with typhoid fever. Great prostration may be combated by the administration of camphor, musk, nux vomica, aromatic spirits of ammonia, and the compound spirits of ether. The patient must be kept quietly in bed, in order to avoid every unnecessary acceleration of the motion of the heart. An ice-bag may be laid over the heart, for the purpose of relieving pain and hindering the process of inflammation. Salicylate of sodium or salicylic acid may be given in doses of ten grains every hour until the physiological effects are produced. The drug may then be given less frequently, so long as it can be tolerated by the stomach. Alcohol should be freely administered, for the purpose of supporting the strength, and

n antidote to the poisons generated by the bacterial microörganisms. h fever may be relieved by the use of antipyrine or acetanilide in s of five to ten grains every three or four hours; but these drugs ıld be used with caution and for no long period of time. The action he kidneys may be assisted by the administration, every two or e hours, of a tablespoonful of the infusion of digitalis with twenty ms of the citrate of potassium in aërated water.

Verrucose Endocarditis—Endocarditis Verrucosa.

ETIOLOGY. This form of endocardial inflammation owes its origin the action of microbes upon the endocardium. No specific micro-ganisms have been discovered as its cause, nor has it yet been ex-ined why in one case they produce ulcerative endocarditis, and in other the verrucose variety of the disease, though Fraenkel and enger have expressed the opinion that streptococcus pyogenes is ncipally concerned in the production of ulcerative endocarditis, ile staphylococcus pyogenes aureus bears a similar relation with the rrucose form of the disease.

Traumatic causes occasionally determine the incidence of inflamma-n upon the endocardium; but it more frequently results from the ects of *cold* or *rheumatism* or other *infective diseases*. *Gout*, *mus-lar rheumatism*, *pneumonia*, *syphilis*, and *gonorrhœa* must also be mbered among the causes of the disease. It is more frequent among les than among females, probably in consequence of the greater bility of the male sex to articular rheumatism. It is during the riod between the twentieth and thirtieth years of life that it is most quently observed.

PATHOLOGICAL ANATOMY. The characteristic changes consist in the oduction of *endocardial vegetations*, which are for the most part formed on the curtains of the cardiac valves, along their lines of contact when ced against each other. These vegetations may vary in size from an crescence that is just visible to a mass as large as a pea. By their gregation they greatly deform the surface of the valve upon which ey are placed, and they produce an obstruction of the blood current it passes through the valvular aperture. The basis of the vegetation sists of the proliferating tissue of the valve, and the mass is still ther enlarged by a fibrinous deposit from the blood itself. In recent es the distinction between the basal layer and the superficial deposit y be easily demonstrated. As a consequence of the valvular lesion, *onic endocarditis* almost invariably follows. The vegetations become anized, the valves upon which they are seated are thickened and dually contract, with subsequent degeneration of a fatty or calcareous aracter. The injured valve frequently becomes anew the seat of fresh acks of inflammation.

The form of endocarditis occurs most frequently upon the left side the heart, probably as a consequence of the fact that freshly oxy-nated blood affords the most favorable conditions for the multiplica-n of the microörganisms which are concerned in the inflammatory ocess. *When the disease occurs before birth* it is seated upon the

right side of the heart, which then contains the most highly oxygenated blood. The vegetative process is manifested usually upon the mitral valve; next in order of frequency, upon the aortic valve; next upon the tricuspid valve; then upon the pulmonary valve; lastly upon the walls of the heart. When it attacks the parietes it is more frequently observed in the auricles than in the ventricles.

As a consequence of extensive vegetation within the cavities of the heart *embolic masses* may become detached, and are swept by the current of the blood into the arteries of the extremities and organs of the body. In this way may be produced the phenomena of *arterial obstruction* with formation of *infarcts* in the organs that are involved, *e.g.*, the brain, spleen, kidneys, and other organs. The consequences of these embolic obstructions are chiefly of a mechanical character, in this respect differing from the suppurative processes that result from the infective nature of the emboli that originate in ulcerative endocarditis.

SYMPTOMS. Subjective symptoms are often either absent, or are of an exceedingly vague and indefinite character. Sometimes the patient complains of discomfort in the præcordial region, or of dyspnœa, or of palpitation accompanied by pain in the epigastric region that sometimes extends into the left shoulder and down the left arm. So frequent is the connection between the affection of the heart and acute articular rheumatism that the possibility of its occurrence should always be remembered in such cases. The only positive symptoms of the endocardial disease are furnished by the valvular defects which grow out of its existence. For this reason it is usually impossible to recognize the existence of parietal endocarditis or of minute valvular vegetations. Only when the auscultatory signs of valvular disease can be recognized as originating in the course of rheumatism or other acute disease, can the observer feel confident of the development of acute endocarditis.

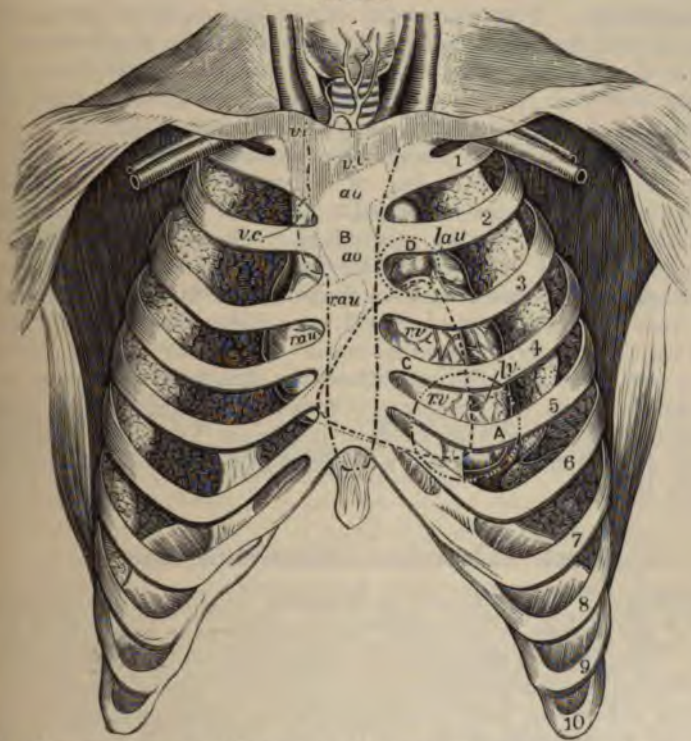
Since it is the mitral valve that is most frequently involved, *auscultation* first detects a systolic murmur at the apex of the heart, which, if not explained away by the existence of anæmic or feverish conditions of the blood, affords a valuable sign of endocardial inflammation. The participation of other valves in the disease will be indicated in like manner by murmurs that correspond with their location. (Fig. 109.) As the disease progresses and as the valves become damaged in greater degree, various murmurs may arise in accordance with the occurrence of obstruction or regurgitation of the blood current. The import of these sounds will be more fully considered in connection with the diseases of the different cardiac valves.

The association of *pericarditis* with endocarditis often obscures the diagnosis of the latter inflammation. It frequently happens that the endocardial murmurs, which are at first distinctly audible, are completely overwhelmed by the intercurrence of pericardial inflammation.

The occurrence of arterial obstruction as a consequence of endocarditis may be easily recognized by the sudden incidence of violent pain in the affected part. In this way *renal embolism* may be recognized by hæmaturia and by the existence of pain in the upper portion of the

s, frequently accompanied by vomiting and febrile reaction. *Splenic olism* is indicated by pain in the left hypogastrium. *Cerebral em- sms* are indicated by disturbances of consciousness, sensation, and power of motion, often of an hemiplegic character. *Obstruction of*

FIG. 109.



Areas of cardiac murmurs (Gairdner for the areas, and Luschka for the anatomy). The outlines of organs, which are partially invisible in the dissection, are indicated by very fine dotted lines, while the areas of propagation of valvular murmurs have been roughly marked by additional coarser and more visible dotted lines, the character of the dots being different in each of the four areas. A capital letter marks each area, viz.: A. The circle of mitral murmurs, corresponding with the left apex. B. The irregular space indicating the ordinary limits of diffusion of aortic murmurs, corresponding mainly with the whole sternum, and extending into the neck along the course of the arteries. C. The broad and somewhat diffused area occupied by tricuspid murmurs, and corresponding generally with the right ventricle. D. The circumscribed circular area over which pulmonic murmurs are commonly heard loudest.

Reference letters: *r. au.* Right auricle. *a. o.* Arch of aorta. *v. i.* The two innominate veins. *v. c.* Vena cava descendens. *p.* Pulmonary artery. *l. au.* Left auricle. *l. v.* Left ventricle. *r. v.* Right ventricle.

he vessels in the extremities is indicated by the occurrence of severe pain in the affected part, with disappearance of arterial pulsation, and the development of coldness and discoloration of the surface, with great difficulty of motion in the affected limbs. *Cutaneous embolism*

produces the phenomena of erythema nodosum. A slight elevation of the internal temperature of the body is usually observed, even though the obstructed portions are considerably refrigerated.

The *endocardial changes* that are produced by verrucose endocarditis persist through life, and become merged in the phenomena of chronic endocarditis with valvular disease.

TREATMENT. The dependence of the disease upon previously existing morbid conditions, renders it evident that no prophylactic treatment is of any avail, unless as such be considered the treatment of the primary infection. When the recent occurrence of endocardial inflammation has been recognized, it will be found useful to cover the præcordial region of the chest with soft folds of light flannel, upon which should be laid an ice-bag of moderate weight, that must be refilled as often as the ice is melted. A febrile condition calls for the administration of antipyrine, acetanilide, or phenacetine in doses of five to ten grains every four hours. In rheumatic inflammation, salicylate of sodium may be substituted in doses of ten to fifteen grains every hour until the physiological effects are produced. It should then be given less frequently. Rapid movement of the heart may be moderated by the administration of digitalis and the citrate of potassium, as recommended in the last chapter. Chronic endocarditis with valvular disease may be treated with iodide of potassium (five to ten grains three times a day), or the syrup of the iodide of iron (half a teaspoonful three times a day).

Chronic Endocarditis—Endocarditis Chronica.

ETIOLOGY. When *chronic endocarditis* originates in the verrucose form of the disease, it is evident that their primary causes must be the same. Besides these causes may be enumerated arterio-sclerotic changes that occur at an advanced period of life. Chronic nephritis, gout, diabetes, arthritis deformans, lead poisoning, chronic alcoholism, and syphilis, may also be enumerated among the causes of the disease. By some observers it has been thought that violent exertions, such as are made by raw recruits on the occasion of hard marches during war-time, may produce a chronic inflammation of the endocardium.

PATHOLOGICAL ANATOMY. The seat of inflammation is indicated by thickening and prominence of the affected portion of the endocardial tissue. In old cases the inflamed tissue may become calcified or ossified. When the valvular curtains are invaded by the disease they become contracted and crumpled. Atheromatous changes are not uncommon.

When the *semilunar valves* are thus invaded, they are either converted into an obstruction to the passage of the blood into the arteries, or, by their inability to close the arterial opening they promote a diastolic regurgitation of the blood into the cardiac ventricle. In this way various disturbances of the circulation have their origin at the entrance of the aorta or of the pulmonary artery.

When the curtains of the ventricular valves are invaded, the disease usually extends to the chordæ tendineæ and the papillary muscles.

ious deformities may thus arise, and the auriculo-ventricular pas-
s may become contracted into mere buttonhole-like orifices.
The situation of the disease corresponds with what has already been
cated for verrucose endocarditis. The disease may extend to the
cular substance of the heart, producing chronic myocarditis. Mitral
ammation is most common during early and middle life; in old age
disease more frequently attacks the aortic valve, in consequence of
greater predisposition to arterio-sclerotic changes during advanced

The disease persists in its chronic form till death. It is also ex-
nely prone to acute exacerbations or relapses. As a consequence of
valvular deficiencies that are produced, the heart becomes hyper-
phied and dilated.

SYMPTOMS. Since chronic inflammation can only be recognized
ough the injuries which it entails upon the valvular structures of the
art, its symptoms become identical with those which characterize
vular diseases and imperfections. It is therefore advisable to pro-
d to a consideration of the

Diseases of the Cardiac Valves.

ETIOLOGY. *Cardiac valvular deficiency* is usually the result of *endo-
rdial inflammation*, but occasionally it may be produced by the
pture of a valve through sudden violent muscular exertion. Some-
nes the valvular defect is caused by *tumors* that encroach upon the
art or develop in its walls. *Valvular aneurisms* and *cardiac throm-
sis* may also obstruct the functions of the valves. *Fatty degeneration
the papillary muscles*, and nervous prostration, may also occasionally
terfere with their function. It usually happens that only a single
lve is involved, but two or more may be affected at the same time.
he mitral valve is generally the seat of deficiency, or the mitral and
rtic valves may both be simultaneously affected. The defect of the
itral valve, or insufficiency of the aortic valve, may also be associated
th insufficiency of the tricuspid valve. It is a very uncommon thing
find three or four of the cardiac valves involved at the same time.

Heredity plays a somewhat important part in the development of
lvular diseases. They are most commonly met with among laboring
ople during middle life.

PATHOLOGICAL ANATOMY. The pathological changes that are pro-
ced by valvular diseases are, in the first place, local alterations that
e manifested in the structures of the heart, and, in the second place,
e changes that result in distant organs by reason of retardation of the
od current, or through the results of embolism.

In addition to the *pathological changes within the heart* that have
en already described upon a preceding page, by which may be pro-
ced either an insufficiency of the valvular curtains themselves, or a
rrowing of the endocardial passages, it must not be forgotten that the
scular structure of the organ may undergo *hypertrophy*, or, finally,
ophy with dilatation of the heart. The *pericardium* may also in-
ate a condition of inflammatory change; and the intima of the aorta
y exhibit fatty and atheromatous degenerations.

The *blood* is usually darker, thinner, and less richly furnished with albuminous constituents than in a state of health. The veins are over-distended, and the serous cavities contain an excess of liquid which may become turbid or colored with hæmoglobin in severe cases, attended by dissolution of the blood. The *respiratory passages* exhibit a catarrhal condition. The *lungs* and the *glottis* may become œdematous. The capillary vessels of the lungs become varicose, and the organs themselves are frequently loaded with pigment, constituting what is called *brown induration* of the lungs. As a consequence of retarded pulmonary circulation, the minute bloodvessels of the respiratory organs may undergo fatty degeneration, with subsequent interstitial hemorrhage, which must be distinguished from the hemorrhagic infarcts that are produced by embolism.

The *spleen* is sometimes enlarged; its capsule becomes thickened and occasionally adherent to the neighboring organs. Through increase of its connective tissue, it is denser and firmer than is natural, and it may also contain embolic infarctions.

The mucous membrane of the *stomach and intestines* exhibits a catarrhal condition. The hæmorrhoidal veins of the rectum are greatly distended. The *liver* is usually enlarged, filled with blood, and of a dark-purple color. The central veins of the acini are greatly distended and contrast strongly with the lighter, sometimes fatty, peripheral portions of the structure, producing the characteristic appearances of the so-called nutmeg liver. Microscopical examination frequently reveals an atrophied condition of the liver, caused by the increase of blood pressure in the capillary vessels. In chronic cases, the connective tissue of the organ becomes increased in amount, and is finally contracted to a degree that effects a reduction in the size of the organ, with a roughening of its surface similar to that which is discovered in cirrhosis of the liver. The mucous surface of the *gall bladder* exhibits a catarrhal condition, with consequent dilution of its biliary contents.

The *kidneys* also exhibit a hyperæmic enlargement. The stellate veins upon the surface of the organ are greatly distended, its capsular investment remains transparent and is easily stripped off from the underlying tissue. The pyramidal portion of the kidney is of a deep-purple color, in strong contrast with its cortical portion. The epithelium and the uriniferous tubules exhibit the appearances of cloudy swelling and incipient catarrhal inflammation. In chronic cases, the epithelial cells have undergone fatty degeneration. The connective tissue in all parts of the kidney becomes increased and, finally, contracted, with consequences similar to those observed in primary contraction of the kidney. Embolic and concomitant infarctions are also sometimes observed.

Similar changes of a hyperæmic and hemorrhagic character may be discovered in the *genito-urinary organs* and in the *pancreas*.

The *cerebral vessels* and *sinuses* are distended with blood; a section of the *brain* exhibits numerous bleeding-points.

The *meningeal cavities* and the *ventricles of the organ* are filled with a serous liquid, and there is an œdematous condition of the *pia mater*.

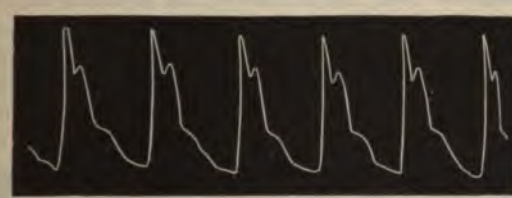
ninges and the *ventricular ependyma* are frequently clouded kened.

TOMS. Before proceeding to a consideration of the general ns of valvular disease of the heart, it will be found advantageous in review the symptoms and signs that are characteristic of ar valvular defects, by which, in fact, the local disease can alone nized. The immediate effects exhibit themselves in changes cardiac structure, producing either hypertrophy or dila- f the affected portion of the heart. So long as the hyper- l muscle can overcome the consequences of valvular deficiency, effectual compensation of the defect; but when, through im- nutrition, such hypertrophy no longer exists, the cavities of rt become enlarged through dilatation and thinning of their Compensation is no longer effected, and the blood current is l, with consequent development of universal disorder in all the body.

Aortic Insufficiency.

ficiency of the aortic valve may consist in a diseased condition r more of its cusps, by which it is rendered incapable of com- sure during cardiac diastole. A portion of the blood within a finds its way back into the ventricle, during the dilatation of rity, with the production of a murmur as it assumes a vortical nt through its contact with the ventricular walls, and its en- with the simultaneous current of blood from the auricle into

FIG. 110.



Pulse of aortic regurgitation. Pressure, 2¾ oz. (FINLAYSON.)

FIG. 111.



Pulse of aortic regurgitation. Pressure, 2 oz. (FINLAYSON.)

tricle. As a consequence of this excessive influx of blood, the tricle is compelled to dilate beyond its ordinary capacity. A mount of blood must therefore be propelled into the aorta dur- systolic contraction of the heart. Constant repetition of this e activity occasions hypertrophy of the left ventricle.

As a consequence of this increased influx of blood, the arterial system becomes over-distended; but the rapid discharge of blood into the capillary system, and its regurgitation into the left ventricle, cause a rapid subsidence of that distention during the period of cardiac diastole. Hence the pulse is full and quick, and the sphygmographic curve is characterized by rapid ascent and speedy descent.

Inspection of the thorax reveals a prominence of the præcordial region produced by the enlargement of the left ventricle. When the thoracic walls are thin and unincumbered with fat, the cardiac impulses can be easily perceived in the neighborhood of the left mammary line. In chronic cases with great enlargement, the cardiac impulses may be observed even as far as the axillary line. Strong systolic impulses may sometimes be felt in the second intercostal space upon the right side of the sternum, as a consequence of dilatation of the ascending aorta, and they may also be traced into the carotid arteries and superficial vessels of the head.

Palpation. If the hand be applied to the præcordial region, a diastolic fremitus or purring sound can sometimes be perceived over the aortic valve. Similar sensations may be experienced in connection with the abdominal aorta and other large arterial vessels throughout the body.

Percussion over the heart reveals enlargement of the left ventricle, causing an extension of dulness beyond the left mammary line and sometimes reaching as far down as the eighth or ninth rib. The position of the right border of the heart remains unchanged.

Auscultation discovers a diastolic murmur at the base of the heart. Seldom loudest in the second intercostal space upon the right side, it is usually most audible over the middle of the sternum and near its left border, for the reason that the vortical movements of the blood by which it is produced occur below the aortic valve and within the left ventricle. These aortic regurgitant murmurs vary in quality and intensity, being sometimes loud and deep, or of a musical character. Loud murmurs overwhelm the diastolic sound of the heart, but when they are soft and faint, the diastolic sound may be perfectly audible along with the regurgitant murmur. The first (systolic) sound at the apex of the heart does not usually undergo any great modification, though it may become associated with murmurs that are transmitted from the aorta, where they are sometimes originated without the occurrence of actual stenosis. As a consequence of ventricular hypertrophy, the first sound may become widely diffused and less clearly defined than in the normal condition. The second (diastolic) sound of the heart is by no means abolished at the apex, as at first might have been anticipated. The intact pulmonary valve and the collision of the regurgitant blood from the aorta against the ventricular wall, suffice to maintain, with considerable integrity, the second sound at the apex during cardiac diastole.

Various murmurs become audible in the larger arteries if they are subjected to auscultation.

It occasionally happens that the injured valve is healed, and that recovery takes place, with complete disappearance of every sign of

ous disease. But far more frequently the valvular insufficiency is formed into aortic stenosis by the persistence of inflammation and ation upon the valvular cusps.

Aortic Stenosis.

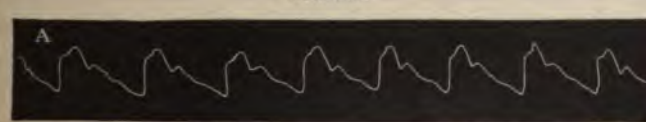
s a consequence of valvular disease producing a *reduction of the eter of the aortic entrance*, the blood current encounters great sition to its passage from the left ventricle of the heart into the . This produces dilatation and hypertrophy of the ventricle, gh not to the extent that occurs as a consequence of aortic valvular ficiency, for the reason that the ventricle is not compelled to receive to propel the excess of blood that regurgitates from the aorta ugh insufficiency of the semilunar valve.

s the blood passes the point of constriction and is forced during car- systole into the dilated aorta, it is thrown into a series of vortical ements, by which a systolic murmur is originated just beyond the tricted entrance to the vessel. Thus is produced the characteristic ic murmur that coincides with the first sound of the heart.

a consequence of the difficulty that accompanies the propulsion of d from the left ventricle, the distention of the aorta and its branches ss than normal, and the time necessary for emptying the ventricle eater than is needed in the normal condition of the valve. Hence pulse is slow and small.

nspection often indicates a diminution or absence of the cardiac ulse. If the left ventricle is considerably hypertrophied there is ble, however, a strong and heaving impulse at the apex, which beats he left and downward from the normal point. The heart is, how- , never as greatly enlarged and displaced to the left as in the ertrophy that follows aortic regurgitation, consequently the præcor- region is less likely to become prominent.

FIG. 112.



rtic stenosis in a patient aged twenty-six. Pressure, 5¼ oz. Loud, rough systolic nur at aortic cartilage; pulse small but hard; evidence of moderate ventricular rtrophy. (FINLAYSON.)

Palpation frequently discovers a systolic fremitus over the base of heart, and particularly in the second intercostal space upon the right of the sternum. It may occasionally be observed as far as the t of the heart. The pulse is small and incompressible; its duration rolonged, and it develops somewhat later than the cardiac systole. sphygmographic curve exhibits a tardy formation of the line of nsion, with gradual development of the descending curve. (Fig.112.)

Percussion indicates an increase of cardiac dulness downward and he left.

Auscultation discovers a systolic murmur which is most audible in the second intercostal space on the right side. It may sometimes be heard all over the cardiac region and in the large arteries of the neck, and even upon the posterior surface of the thorax. It can be heard sometimes at a considerable distance from the body of the patient. The intensity of the sound is, however, no indication of the extent of the disease by which it is caused, since it has been discovered that noisy murmurs may be associated with slight anatomical changes.

The second aortic sound is very faint or entirely absent, in consequence of the diminished tension of the blood within the aorta. The other sounds of the heart exhibit no change, though they may be obscured sometimes by the strength of the aortic murmur.

Mitral Insufficiency.

In consequence of *insufficiency of the mitral valve*, the systolic contraction of the heart causes a regurgitation of blood from the left ventricle into the left auricle, which thus is compelled to receive blood from two sources, the ventricle and the pulmonary veins. The auricle must therefore become dilated in order to accommodate this excess; but by reason of the pressure that is imparted to the blood as it regurgitates from the ventricle, the discharge of blood from the pulmonary veins is greatly retarded, and they remain in a condition of distention. The capillary vessels within the lungs are thus over-distended, a condition that hinders the progress of blood through the branches of the pulmonary arteries. This occasions opposition to the flow of blood out of the right ventricle, which must therefore become dilated and hypertrophied. In like manner, the right auricle is hindered from emptying its contents easily into the right ventricle, the blood current is pushed back into the venæ cavæ, and the whole venous system remains in a condition of permanent over-distention, while upon the opposite side of the circle the aorta and the arterial system receive less than the normal supply of blood.

Along with these changes the left ventricle must become somewhat dilated and hypertrophied as the increasing vigor of the right side of the heart tends to compensate the insufficiency of the mitral valve by urging the blood with increased force through the lungs into the left auricle.

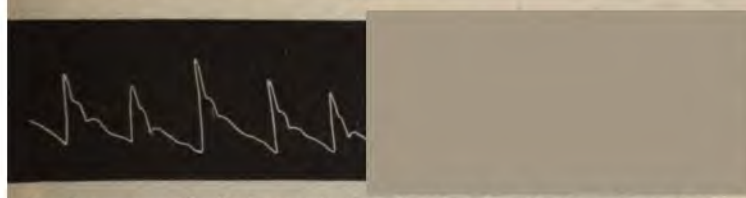
During cardiac systole, as the blood regurgitates through the insufficient mitral valve it meets the opposing current from the pulmonary veins, and it is thrown into a vortical movement within the cavity of the left auricle. A systolic murmur is thus produced, which coincides with the first sound of the heart, and is most distinctly audible at its apex.

Inspection indicates prominence of the cardiac region when there is considerable hypertrophy of the right ventricle. This hypertrophy must be very considerable, to displace the apex from its normal position. When both ventricles are hypertrophied, there may then be considerable displacement of the cardiac impulse in a downward and outward direction. General diffusion of the cardiac impulse may be discovered over the lower portion of the sternum in cases of considerable hypertrophy of

right ventricle. If the pulmonary artery is greatly distended, a olic impulse may be perceived in the second intercostal space upon left side of the sternum. If the *foramen ovale* remains open, the s in the neck pulsate visibly by reason of the retrograde impulse pagated directly from the left ventricle through the insufficient al valve and the patulous *foramen* into the right auricle and the *æ cavæ.*

Palpation sometimes discovers a fremitus over the apex of the heart, this is frequently perceptible only after violent muscular exertion, luring a recumbent position upon the left side. The cardiac impulse nusually evident along the right side and lower extremity of the num. Pressure with the finger in the second intercostal space upon left side of the sternum discovers an impulse which alternates with apex beat. It corresponds with the diastolic closure of the pulmo- y valve, and is consequent upon hypertrophy of the right ventricle. pulse at the wrist is generally normal, though in advanced stages he disease, as the compensatory vigor of the ventricular muscle s way, it may become irregular. The sphygmographic indications ibit nothing that is specially characteristic or diagnostic of valvular ase. (Fig. 113.)

FIG. 113.



acing from a case of mitral regurgitation, showing the pulse irregular in force and rhythm. (FINLAYSON.)

Percussion indicates an extension of cardiac dulness toward the ht, when the right ventricle alone is hypertrophied. Enlargement both sides of the heart is indicated by an extension of the area of ness in every direction.

Auscultation reveals a systolic murmur at the apex of the heart, ich also may be heard frequently over the region of the tricuspid l pulmonary valves. This murmur is often transmitted to the left l can be heard even at the angle of the scapula. The diastolic md at the pulmonary valve is considerably accentuated as a con- quence of an increase of blood pressure within the pulmonary artery t is produced by hypertrophy of the right ventricle.

Cases of mitral insufficiency seldom persist without the development mitral stenosis through contraction of the auriculo-ventricular ring. mplete recovery has been occasionally noted by competent observers.

Mitral Stenosis.

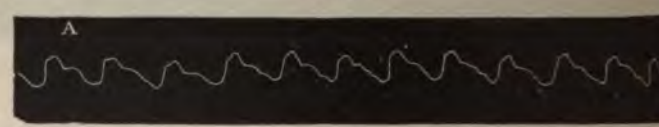
Contraction of the auriculo-ventricular passage effects a hindrance he transit of blood from the left auricle into the left ventricle, hence onsiderable increase of blood pressure in the pulmonary circulation

with its remote effects upon the right side of the heart. Hence, also, tardy filling of the left ventricle and diminution of blood pressure in the arterial system. As a consequence of this condition the right ventricle becomes dilated and hypertrophied, while the left ventricle remains but little changed. The blood, streaming slowly from the auricle into the left ventricle during cardiac dilatation, produces a diastolic murmur that is developed at the auriculo-ventricular opening, as the left ventricle gradually fills itself. This murmur is therefore most distinctly audible at the apex of the heart during the interval between the second sound and the first.

Inspection brings to light a prominence of the cardiac region produced by enlargement of the right ventricle. Increase of blood pressure in the pulmonary artery is indicated by pulsation in the second intercostal space upon the left side, and there is diffusion of the cardiac impulse along the right border of the sternum. The apex beat is not displaced unless there be hypertrophy of the left ventricle or unusual enlargement of the right side of the heart.

Palpation reveals a presystolic fremitus over the apex. It, however, may require violent muscular exertion or the recumbent position upon the left side to develop this sensation. The increased cardiac impulse along the right border of the sternum can be distinctly felt with the hand. The pulse at the wrist is usually small and compressible, and is frequently irregular. The sphygmographic pulse curve exhibits nothing of a diagnostic character. (Fig. 114.)

FIG. 114.



Mitral stenosis. Patient aged sixteen; pulse 100; pressure, three ounces; well-marked auricular systolic murmur and thrill. (FINLAYSON.)

Percussion indicates the extension of cardiac dulness to the right, as a consequence of hypertrophy of the right ventricle.

Auscultation usually renders audible at the cardiac apex a presystolic murmur, which ceases at or just before the commencement of the systolic sound of the heart. There is no murmur with the first or second sounds, nor during the brief interval between. The pathological murmur occurs during the longer interval between the second (diastolic) sound and the first (systolic) sound.

As a consequence of right ventricular hypertrophy the second sound of the heart is accentuated over the region of the pulmonary artery. The first sound at the cardiac apex is frequently accentuated by reason of the increased vibration of the curtains of the mitral valve. The second sound may be sometimes absent, though it is reinforced occasionally by accentuation of the sound that is produced by closure of the pulmonary valve.

Stenosis of the mitral valve is frequently complicated with insuffi-

ncy of the same valve. In such cases the symptoms of stenosis may quite obscured by those of insufficiency. The prognosis of the dis- is still more unfavorable than in simple mitral insufficiency, yet asionally recovery has been observed.

Insufficiency of the Pulmonary Valve.

Insufficiency of the semilunar valves at the entrance of the pulmonary ery permits regurgitation of the blood from the pulmonary vessel the right ventricle during cardiac diastole, with the consequent duction of a diastolic murmur in the conus arteriosus. The right tricle becomes charged during diastole with blood that is regurgi- ed from the pulmonary artery in addition to the usual amount eived from the right auricle. Dilatation and hypertrophy of the tricle are the necessary consequences of this condition.

Inspection of the cardiac region discovers the characteristic appear- es that accompany enlargement of the right heart.

Palpation reveals a similar diffusion of the cardiac impulse toward right, and also a diastolic fremitus in the second intercostal space on the left side of the sternum and over the lower portion of the astbone. The cardiac impulse exhibits no modification either at apex or in the radial pulse.

Percussion indicates increased dulness over the right heart.

Auscultation discovers a diastolic murmur with the second sound the heart in the second intercostal space upon the left side. It also frequently audible over the lower portion of the sternum and at e entrance of the aorta. The second sound of the heart is inaudible er the pulmonary artery, except in those cases in which it is con- ucted from the aortic valve, or in which a portion of the pulmonary lve has escaped injury.

Insufficiency of the pulmonary valve is a very rare disease, yet it is sociated sometimes with stenosis of the valve. It is sometimes the nsequence of congenital defects, or it may exist as a consequence of juries, arterio-sclerosis, rheumatism, or primary valvular disease in e left heart.

Stenosis of the Pulmonary Valve.

In stenosis of the pulmonary valve the blood meets with opposition its passage during cardiac systole, from the right ventricle into the ulmonary artery. This produces dilatation and hypertrophy of the ght ventricle. The pulmonary artery fills slowly, and the blood ressure within its cavity is less than normal. A systolic murmur, in nsequence, arises at the entrance of the artery.

Inspection indicates prominence of the heart region, especially along e left border of the sternum. Systolic vibration may be noted over e lower portion of the breastbone. The impulse at the apex is rcely perceptible. Epigastric pulsation can be often seen.

Palpation discovers a systolic fremitus, most perceptible over the ond intercostal space upon the left side. The pulse at the wrist ex- its no marked change.

Percussion shows an extension of cardiac dulness towards the right.

Auscultation reveals a systolic murmur in the second intercostal space upon the left side. It is sometimes loud and musical, and may be heard all over the cardiac region. The second sound of the heart is absent, or very weak, over the region of the pulmonary artery, by reason of the diminution of blood pressure in that vessel. The other heart sounds may remain without change.

Stenosis of the pulmonary valve is a very rare occurrence among adults, unless it be of congenital origin, when it may be associated with other defects of ante-natal date.

Insufficiency of the Tricuspid Valve.

Insufficiency of the tricuspid valve permits the regurgitation of blood from the right ventricle into the right auricle during cardiac systole. This produces dilatation and hypertrophy of the right auricle and the right ventricle. By the regurgitative process a systolic murmur is produced in the right auricle, and the blood is further driven back into the venæ cavæ with the consequent production of pulsation in the large veins in the neck and trunk of the body.

Inspection. The cardiac region frequently appears prominent. There is a diffuse impulse over the right heart, but the most conspicuous visible signs are connected with the large veins in the neck. Continued dilatation of these vessels occasions insufficiency of their valves, and each regurgitant blood wave produces a visible impulse even as far as the facial, temporal, and auricular veins. As the process of venous dilatation progresses, similar pulsations may be discovered in all the principal veins of the body and extremities. Under these circumstances the liver may be seen to pulsate like an aneurism.

Palpation indicates a diffusion of the cardiac impulse toward the left, and sometimes systolic fremitus may be felt over the inferior portion of the sternum. The radial artery is imperfectly filled at the wrist, and the sphygmographic curve indicates diminished blood pressure and a sluggish movement of the arterial wall.

Percussion indicates considerable increase of cardiac dulness toward the right.

Auscultation renders audible a systolic murmur along the right border of the sternum between the second and fourth costal cartilages. It is sometimes audible over the entire heart, and even at a considerable distance from the thorax. The second sound, at the entrance of the pulmonary artery and over the right ventricle, is faint, by reason of the reduction of blood pressure in that vessel.

Uncomplicated insufficiency of the tricuspid valve is of exceedingly rare occurrence. It may be present as a secondary consequence of valvular disease upon the left side of the heart through enlargement of the organ and consequent distention of the right auriculo-ventricular passage, rendering it impossible for the valve to close sufficiently the enlarged opening.

Stenosis of the Tricuspid Valve.

Uncomplicated *stenosis of the tricuspid valve* scarcely ever occurs. is generally associated with valvular disease of the left heart. It asions dilatation and hypertrophy of the right auricle, with increased ssure in the venæ cavæ, and a reduction of pressure in the right tricle and in the pulmonary artery, as well as throughout the left rt and the entire arterial system. Obviously if a murmur be audi- it must be either diastolic, or presystolic and audible over the region the tricuspid valve. There will also be an increase of cardiac dul- s over the right auricle, and a diminution of the second sound at the rance of the pulmonary artery.

Stenosis of the Heart.

As a consequence of inflammation of the connective tissue in the rocardium, the conus arteriosus upon either side of the heart may come diminished in diameter with consequent hindrance of the free ssage of blood from the ventricle into its corresponding artery. This nstitutes what is called *stenosis of the heart*. The symptoms are ose that are produced by valvular stenosis, with the exception that in rdiac stenosis the second sound is fully formed and sharply defined, us indicating integrity of the valvular structures, a condition which es not exist in ordinary valvular stenosis.

Associated Defects of the Cardiac Valves.

Since each one of the cardiac openings may become the seat of either sufficiency or stenosis of its valve, and since two or more of those ructures may, at the same time, exhibit morbid change of function, e number of combinations and permutations that are possible is very reat. A combination of *insufficiency and stenosis* may be presented y the same valve, and sometimes may admit of recognition during life. n other cases, the signs of either *insufficiency or stenosis* may be eveloped so extensively that the associated condition remains undis- vered. In certain instances the association of the two defects suffices r their compensation, so that the cardiac circulation is not materially sturbed. A good example of this is furnished sometimes by the con- rrence of *aortic stenosis* with *insufficiency of the aortic valve*. Dur- g a cardiac diastole the existence of stenosis prevents any considerable gurgitation of blood from the aorta, and during contraction of the pertrophied left ventricle the aorta is protected from over-distention the narrowing of its entrance. In like manner, *stenosis of the left riculo-ventricular opening* may obviate the evil consequences of asso- ted *insufficiency of the aortic valve*. But, on the contrary, *stenosis the aortic valve* causes increase of the unfavorable conditions that caused by the associated existence of *mitral insufficiency*. The erial system receives less blood, and the venous system becomes re excessively distended than would be possible with mitral insuf- ency alone.

The general symptoms of valvular disease of the heart depend upon the changes that are produced in the circulation of the blood. So long as the nutrition of the heart is sufficient to enable its hypertrophied muscles to overcome existing obstacles to the progress of the blood, no disturbances of the health will occur, but so soon as compensation fails, disturbances of circulation will arise and may extend to the most distant organs of the body. The *exciting causes* of such compensatory failure may be found in every form of extraordinary muscular exertion and fatigue Worry and care, the abuse of tea, coffee, and alcohol, exercise an unfavorable influence. Pregnancy, childbirth, lactation, imperfect nutrition, intercurrent diseases, and the renewal of endocardial inflammation, all exercise the most unfavorable influence upon the functional vigor and efficiency of the heart.

By reason of the tendency of valvular disease of the heart to produce disorder in other organs of the body, it becomes a matter of the highest importance to avoid the misleading indications derived from such disturbances by which the superficial observer may find his attention diverted from the real source of disorder.

So long as valvular defects are sufficiently compensated by *healthy hypertrophy of the cardiac muscles* the patient may experience no subjective symptoms, or they may become apparent only when the heart is roused to unusual activity by violent exertion or by excess in eating and drinking, or by the recumbent position upon the left side. Not unfrequently, however, does the patient complain of a feeling of constriction about the thorax, or of difficulty in breathing, or of other indefinite sensations of discomfort. The occurrence of *valvular disease in early life* is liable to occasion imperfect physical development. Sometimes as a consequence of defective nutrition, a high grade of cachexia becomes apparent. The tips of the fingers may become clubbed and of a claw shape, by reason of these errors of nutrition.

A *cyanotic condition* of the skin is usually evident. This corresponds in degree with the amount of obstruction to the pulmonary circulation, and is, therefore, more commonly connected with mitral disease than with aortic.

The skin is not unfrequently *jaundiced* to a greater or less degree. This condition is usually of gradual development and chronic duration, but it sometimes originates suddenly as a consequence of embolic processes in the liver.

The *minute veins* in the cheeks and upon the nose are frequently distended, and the occurrence of *acne rosacea* may be observed as a consequence of circulatory disturbances. A *varicose condition of the superficial* veins may be developed with all the attendant evils of such a disorder. Actual *extravasation of blood* into the cutaneous tissues may occur either as a consequence of cutaneous embolisms, or by reason of the development of a genuine hemorrhagic tendency that reminds the observer of the phenomena of *purpura hæmorrhagica.*

Œdema is one of the most frequent and persistent consequences of valvular disease. In depends for its existence upon increasing blood pressure in the venous and lymphatic systems, and also upon alterations in the quality of the blood, and in the structure of the walls of

capillary vessels, which render them more permeable by the liquid tions of the blood.

The occurrence of *dropsy* is first noticed, in the lower extremities, und the ankles, which swell during the daytime and subside at night le the patient is in bed. As the disease progresses, this condition be- ies constant and extends upward until it occupies the whole of the low- xtremities and invades the external sexual parts, and the subcutaneous ues of the body, finally reaching the upper extremities and the face. ig duration of this condition is usually attended with thickening of subcutaneous areolar tissue. The epithelial surface of the skin may become thickened, inflamed, and blistered, after a fashion that is ngly suggestive of erysipelas. The skin may finally rupture, and oozing of serum may thus become established. If life be sufficiently longed, ulceration and gangrene of the skin may also occur.

The *serous cavities of the body* are in like manner invaded by the psical transudation. The peritoneal cavity is usually involved at an ly period; after that, the cavities within the thorax, and finally the ces within the cranium, may become distended in like manner. It evident that such accumulations of liquid cannot be formed without ious interference with the functions of adjacent organs that are thus jected to an unusual degree of pressure.

The *cavities of the joints* sometimes become distended and painful, en though every indication of rheumatism is absent. The tempera- re of the body may remain normal, or it may sink below the natural rel. Its elevation is usually caused by the intercurrence of embolic ocesses. The pulse is generally frequent, feeble, and weak or inter- ittent. Palpitation of the heart, which may be either genuine or only bjective in its character, is a very common occurrence. Uneasy sensa- ons in the cardiac region are not unfrequent. In many cases they e apparently due to irritation of the cardiac plexus through dilatation the aorta.

As a consequence of endocardial disease, *thrombosis may occur within he cavities of the heart.* Detached portions of such clots may be car- ied by the course of the circulation into distant organs, where they ccasion embolic processes. Sometimes the extension of the endocardial lots into the branches of the pulmonary artery may produce an arrest f the circulation and sudden death.

It occasionally happens that the excessively dilated or degenerated eart muscle ruptures and produces *sudden death.*

In the majority of cases there is great complaint of *want of air.* his sometimes occurs periodically, sometimes in connection with car- iac palpitation or other excitement. It may be caused by mechanical ressure upon the lungs, through great enlargement of the heart, or by eason of the occurrence of hydrothorax or ascites. Over-distention f the stomach may produce a similar effect, but in many cases it seems depend upon pulmonary disorders, such as hemorrhagic infarcts, or ronchial catarrh, or the direct compression of the left bronchus by an ypertrophied portion of the heart. As a consequence of these pul- onary disturbances, the patient may cough, and may expectorate lood for a considerable period of time, especially when pulmonary in-

farction has taken place. In certain cases the expectorated matter resembles the brownish sputum of pneumonia. Microscopical examination of such sputa reveals the presence of large granular epithelial cells, with an abundance of pigment and crystals of hæmatoidin, derived from the blood that has been extravasated within the lungs.

Death is not unfrequently caused by *œdema of the lungs*. Sometimes it may be produced by *œdema of the glottis*. *Inflammation of the lungs* is a not uncommon occurrence. *Epistaxis* sometimes happens. *Increase of pressure in the bloodvessels of the head* is indicated by dizziness, humming in the ears, and flashes of light before the eyes. Opposite conditions of *cerebral anæmia* occasion persistent weakness and prostration.

Loss of appetite and indigestion are very common as a consequence of *catarrhal states of the digestive organs*. Extravasation of blood into the mucous membrane of the mouth is sometimes observed as a consequence of *dissolution of the blood*. Attacks of *cardialgia* are sometimes referred to conditions of the stomach rather than to their actual source in the heart, especially when accompanied by obstinate vomiting that suggests ulceration of the stomach. The *bowels* are generally constipated, though occasionally there is diarrhœa. *Hæmorrhoids* are frequently present, and intestinal hemorrhage sometimes occurs in consequence of their existence, or by reason of embolic processes in the mesenteric vessels.

The *liver* is often considerably enlarged, producing a sensation of tension and weight, or even of pain in the right hypochondrium. The lower border of the organ can be felt distinctly below the ribs. In chronic cases the liver sometimes becomes reduced in size.

The *spleen* is less frequently enlarged, since the portal circulation seems to shield that organ from the direct effects of retrograde blood pressure.

As the compensatory vigor of the heart fails, the *urine* diminishes in quantity, deepens in color, and increases its specific gravity, frequently depositing an abundant sediment of urates when cooled. Hæmaturia does not often occur unless the kidneys become inflamed or involved in embolic processes. A *catarrhal condition of the genito-urinary organs* is occasionally observed. In the female sex, there is *leucorrhœa* and *profuse menstruation;* in the male sex, *varicocele* and *hydrocele* are not uncommon. Embolic, hemorrhagic, and inflammatory processes are sometimes visible in the *retina*.

In addition to the cerebral disturbances that have been mentioned, *intra-cranial hemorrhage* sometimes occurs, in consequence of arterio-sclerosis or fatty degeneration of the cerebral vessels. *Epileptiform attacks* may accompany such changes.

The occurrence of valvular lesions within the heart in early life interferes with the *growth* and *healthy development* of the patient; such children are listless, timid, and slow to learn. In later life *hypochondria* and *melancholia* sometimes develop, though a tendency to insanity is not remarkable among cardiac patients.

The *embolic processes* that may originate in cardiac disease require special notice. When they proceed from the *right heart*, the branches

the pulmonary artery are the seats of obstruction, and hemorrhagic infarctions are produced in the lungs. They may be recognized by their wedged-shaped form, the base of the pyramid being directed toward the periphery of the lung, and its apex toward the point of obstruction, where the embolus may be discovered on section of the arterial twig. The emboli that proceed from the *left heart* are most frequently discovered in the arteries of the extremities and in the splenic, renal, cerebral, gastro-intestinal, hepatic, and cutaneous arteries. The occurrence of such obstruction may be recognized by local pain, followed by elevation of the temperature, with chills, fever, and sweating when the internal organs are involved, and followed by fall of temperature and disappearance of arterial pulsation beyond the point of obstruction when the circulation in the extremities is involved. The left lower limb is more frequently affected than the right, because of the greater directness of the passage of blood into the left bifurcation of the aorta. Sometimes the entire lower portion of the body and the lower limbs are deprived of blood through obstruction above the aortic bifurcation. In other cases simultaneous closure of both iliac arteries may occur. The temperature of the limbs falls rapidly. The toes grow dry and mummified, while the fleshy portions of the leg and thigh tend to fall into a condition of moist gangrene. Similar processes may be observed in the upper extremities. Embolism of the cerebral arteries occurs more frequently in the territory that receives its blood through the left carotid artery, because that vessel furnishes the most direct course from the heart to the brain. The left Sylvian artery is the favorite seat of embolism. Aphasia and hemiplegia may be thus produced.

The *formation of thrombi* is observed sometimes in the large veins. Detached portions of these clots may find their way into the right heart, and thence into the branches of the pulmonary artery, producing sudden death.

It is hardly necessary to allude to the increased dangers that attend *intercurrent diseases* when associated with valvular disease of the heart. The already overburdened organ must necessarily be found less capable of enduring the depressing influences of fever and the other incidents of acute disease. Especially is this the case when diseases of the organs of respiration or the processes connected with pregnancy and childbirth add to the difficulties that attend the circulation of the blood.

The *duration of valvular disease* depends largely upon the nature of the lesion and the endurance of the patient; occurring in early life, it greatly shortens the period of existence; debilitated patients may finish their course in a few weeks or months. As a general rule, aortic defects are more consistent with length of life than other forms of valvular disease, for the reason that the superior muscular vigor of the left heart is favorable to the process of compensation.

Diagnosis. The diagnosis of valvular lesions depends upon the physical signs previously enumerated. It will be useful to mention the particular difficulties that interfere with diagnosis.

It is easier to recognize those defects that are accompanied by a *systolic murmur* than those which produce a *systolic murmur*, for the

reason that the first hardly ever have any other cause than the actual lesion, while murmurs of the second variety may originate in febrile or anæmic conditions of the patient. A systolic murmur can be ascribed to valvular lesions only when dilatation and hypertrophy of the corresponding portion of the heart are present. *Hypertrophy of the right ventricle*, it must be remembered, is accompanied by accentuation of the second sound at the entrance of the pulmonary artery, while *hypertrophy of the left ventricle* is indicated by unusual strength of the pulse at the wrist. Accidental murmurs are generally unaccompanied by the occurrence of fremitus. It must not be forgotten that endocardial murmurs are sometimes absent during repose. The subject of examination should therefore be made to execute active muscular movements, and should be examined in different positions, in order to arrive at a positive diagnosis. It is generally the case that an endocardial murmur belongs to the valve in connection with which it is most audible. The fact that the diastolic murmur which accompanies insufficiency of the aortic valve is generally louder over the middle of the sternum, must be explained by the fact that the murmur is not produced in the valvular opening, but within the ventricle where the vortical movements of the blood occur. For a similar reason the systolic murmur of mitral regurgitation is often loudest over the apparent entrance of the pulmonary artery.

Other difficulties which may arise in connection with diagnosis must be overcome by a careful consideration of the various physical signs that have been enumerated on preceding pages.

PROGNOSIS. The prognosis in valvular disease is always unfavorable. Disease of the aortic valve, for reasons already mentioned, is less dangerous than diseases of the other valves. The extension of disease to more than one valve increases the dangers to which the patient is liable. The occurrence of cardialgia, palpitation, irregularity of the cardiac movements, intermittence of the pulse, feeble contraction of the heart, with progressive diminution of its activity, are all indications of failing energy and of increasing danger.

Among external conditions that unfavorably affect the prognosis may be mentioned poverty, hunger, and the exigencies of a laborious life, though a constitutional weakness is also of unfavorable import.

TREATMENT. Unfortunately there is no remedial agent that exerts any direct or perceptible influence upon the healing of valvular lesions of the heart. Iodide of potassium, mercury, chloride of ammonium, inhalations of the carbonate of sodium, and blisters over the cardiac region, have all been employed without appreciable result. The use of brine-baths is occasionally attended with favorable results, but disappointment is the rule. The principal indication for treatment is the preservation of the compensatory power of the heart. This must be effected by a wholesome diet, consisting principally of milk, eggs, broths, lean meat, stewed fruit, and such vegetables as the experience of the patient has recommended. Palpitation and difficult respiration may be somewhat relieved by the substitution of small and frequent repasts for the ordinary substantial daily meals. Strong tea and coffee and spirituous liquors should be forbidden, though it may be advisable in

ebilitated cases to make use of moderate quantities of wine and beer. ny considerable amount of liquid beyond the actual necessity of the atient should be avoided, because of the increased embarrassment of he heart that follows any increase in the amount of fluids that must irculate through that organ. All forms of violent exercise must be rbidden, also hot and cold baths should be discontinued, though cold ponging may be permitted. Gentle exercise in the open air is always esirable. The bowels should be moved every day; if this cannot be ccomplished by the use of fruits and vegetables as a part of the diet, he patient must have recourse to the aid of aloes and rhubarb (com- ound rhubarb pills). The bitter waters, such as Frederichshall or Hunyadi-János, are useful.

During the cold months of the year the patient may seek a warm limate with advantage; but it must not be forgotten that sea voyages nd long journeys sometimes conduct enfeebled cases to a speedy ter- nination.

When the signs of heart failure appear as a consequence of excessive ilatation or degeneration of the cardiac tissues, it becomes necessary o resort to the administration of remedial agents. Chief among these re the preparations of digitalis. These are especially useful in cases that re marked by feeble and irregular movement of the organ. The atient should be kept in bed, and an ice-bag may be laid over the eart, in order to retard its accelerated movements. A tablespoonful of he infusion of digitalis may be administered every two hours, and with his may be associated sufficient doses of bitartrate of potassium in con- tipated conditions of the bowels. If digitalis disturb the digestive rgans, it will be found useful to add a small quantity of dilute alcohol o the infusion, or to substitute some other remedy in its place. This ecomes absolutely necessary when the cumulative effects of the drug re developed, *e. g.*, a slow and irregular pulse, cerebral confusion, ashes of light before the eyes, humming in the ears, vomiting, epi- astric pain, diarrhœa, and general prostration.

When a considerable degree of cyanosis marks the course of the dis- ase it becomes necessary to employ cardiac stimulants in association ith digitalis. For this purpose, whiskey and water, valerian, and amphor, may be employed. A grain each of camphor, powdered igitalis, and capsicum, may be given in pill form every two or three ours.

Sluggish kidneys may be stimulated advantageously by the admin- tration of citrate of potassium, in scruple doses, with a tablespoonful the infusion of digitalis, added to a half-tumblerful of water, every o hours. A powder containing two or three grains of calomel and a ain of powdered digitalis may be given three times a day during three ccessive days, for the same purpose. The mouth should be protected the same time against salivation by frequent gargling with a five per nt. solution of the chlorate of potassium.

As a substitute for digitalis, may be given the tincture of strophan- us in ten-drop doses three times a day; or the sulphate of sparteine hree grains three times a day); or hypodermic injections of the soluble lts of caffeine, preferably the sodio-benzoate or the sodio-salicylate of

caffeine, which may be employed in two-grain doses once or twice a day. Less reliable preparations are the infusion of Adonis vernalis, and the infusion, or the tincture, of convallaria majalis.

Anæmic patients require the administration of iron, which may be given in the form of iron by hydrogen. Of this, three grains, with half a grain each of quinine and powdered digitalis, may be given in pill form four times a day. Mineral waters containing iron are useful in many cases.

Pulmonary symptoms must be treated with expectorants, and with styptics if hemorrhage should occur.

Cardiac palpitation and distress may require the hypodermic use of morphine. To this may be added a minute quantity of atropine if the patient be not over-sensitive to the disagreeable effects of that remedy. It is desirable to postpone this method of relief to the latest possible period consistent with the comfort of the patient.

The development of dropsy may sometimes be hindered by a milk diet, especially if that article of food be relished by the patient. It should be boiled, and drank in small quantities frequently, and the daily amount may be increased until it reaches two or three quarts. In this way extensive œdema may be rapidly reduced in many cases. But when diuretics and drastic cathartics fail to reduce the dropsical accumulation, it is necessary to resort to the frequent use of hot air baths. The patient should lie in bed, wrapped in a woollen blanket, with the bed-clothing supported above his body by a light framework. A current of hot air may then be introduced under the clothing through the pipe of a tin stove containing a spirit-lamp at the foot of the bed. In this way perspiration may be excited and continued for an hour, or longer. Daily repetition of this process increases its efficiency. But when all other measures fail it becomes necessary to puncture the lower limbs of the patient. This may be effected either by simple puncture of the skin, with a sharp awl, at different points upon the swollen feet and legs, which should then be wrapped in soft cloths and covered with oiled cloth or rubber sheeting, to prevent saturation of surrounding objects. Still more effectual is the employment of Southey's trocar and canula, which may be introduced into the dropsical limbs with appropriate antiseptic precautions.

CONGENITAL VALVULAR LESIONS OF THE HEART.

Congenital Cyanosis—Morbus Cœruleus.

Etiology and Pathological Anatomy. *Valvular defects within the heart* may originate during fœtal life. They occur most frequently upon the right side of the heart, which, before birth, receives oxygenated blood from the placenta, and is more actively engaged than the left heart in the ante-natal circulation of the blood. Not only the valvular structures, but the cardiac walls and the fœtal passages, such

ıe foramen ovale and the ductus arteriosus, may be involved. It long believed that endocardial inflammation was the cause of the rved lesions, but there is a growing belief that these defects may e their origin not unfrequently in defective development of the car- structures. They are more frequently observed in male children ı in female, and often their hereditary occurrence has been remarked.

YMPTOMS AND DIAGNOSIS. The most conspicuous symptom of genital endocardial defect is *cyanosis*, though cases have been cribed in which communications between the right heart and the were discovered after death without the occurrence of cyanosis ing life. The discoloration of the skin is usually increased by ry agitation and exertion on the part of the patient. The symptom exceedingly conspicuous at the moment of birth, and is usually owed by the speedy death of the infant. If life be prolonged, such ldren are liable to suffocative or convulsive attacks which sometimes minate in death. The bodily development is usually retarded and icient, the eyeballs are sometimes excessively prominent, the nose ned up, the lips and the finger-nails are blue, and the ends of the fin- s and toes are club-shaped so that the hand assumes somewhat the earance of a claw or talon. Along with other symptoms of ective nutrition the patients complain of chilliness, and their tem- ature is subnormal. A disposition to pulmonary consumption is uncommon.

The physical signs that are connected with the heart are, for the t part, identical with those which have been already enumerated in nection with valvular lesions of the heart.

PROGNOSIS. Death often occurs immediately after birth or in early . It is an uncommon thing for a patient to live beyond the age of urity. Death occurs as a consequence of pulmonary tuberculosis ther intercurrent diseases with symptoms of blood stasis. Life is letimes terminated by convulsions.

TREATMENT. The general rules for treatment that have been given a preceding page must guide the care of these patients. Inhalation oxygen and of compressed air has been recommended for the relief cyanosis, but the good effects of such experiments must necessarily transitory.

Cardiac Thrombosis.

Loose dark clots of blood of variable size can be found after death in cavities of almost every heart, especially upon the right side of that an. Sometimes they have become considerably discolored and inous, presenting an elastic and semi-organized appearance. These sses form at the time of death, especially when the movements of the rt have been enfeebled or retarded for some time before the termi- ion of life. They must not be mistaken for *true cardiac thrombi.* ese structures are closely adherent to the endocardial wall and uire considerable force for their separation; they are also of a much ner consistency than that of the heart clots. Their color is of a wnish red or gray, and the older they are the more colorless they ear. They are most frequently observed in the auricular appendices

and near the apex of the heart, especially upon the right side of the organ In size they vary from the head of a pin to a hen's egg. They may occur singly or in considerable number. Sometimes the central portion becomes softened and occupied by a brownish red liquid resembling the contents of a cyst. Microscopical examination, however, excludes pus cells, and reveals only the presence of degenerate round cells with hæmatoidin and granular detritus. Sometimes the mass becomes calcified. In certain cases a thrombus may protrude into other cavities besides those in which it had its origin, extending even into the aorta and its branches. It is obvious that embolic processes in distant parts of the body may have their origin in detached portions of a cardiac thrombus.

ETIOLOGY. Without previous injury or disease of the endocardium a *thrombus* cannot be formed. The existence of the disease therefore implies the previous occurrence of retardation of the blood current and the incidence of other cardiac diseases by which the endocardial lining becomes detached at certain points. Where that has taken place the deposit of fibrin follows, and is attended with a low grade of organization by which the structure of the thrombus is built up. The same causes also which occasion the organization of thrombi in the peripheral veins may lead to their growth within the heart.

SYMPTOMS. In many cases there are no symptoms, and the disease is only discovered after death. In other cases the symptoms are those which characterize a debilitated condition of the heart, *e. g.*, feeble impulse, imperfectly audible heart sounds, irregular cardiac movements, faintness, dizziness, flashes of light before the eyes, partial deafness, humming in the ears, formication, chilliness, pallor, lividity and coldness of the skin, with a feeling of dyspnœa that is not dependent upon pulmonary disease. In other cases the symptoms are those which indicate *valvular defects*, and they are produced by encroachment of the thrombotic mass upon an endocardial valve. In other cases the symptoms depend upon *embolic processes* which have their origin in the detachment of particles from the thrombotic growth.

DIAGNOSIS. A positive diagnosis is impossible during life, though specialists have undertaken to formulate rules for the recognition of endocardial growths. Such efforts, however, exhibit a theoretical refinement that is quite beyond the possibilities of clinical observation.

TREATMENT. No special rules can be laid down for the treatment of cardiac thrombus. Symptoms must be met as they occur.

CHAPTER II.

ES OF THE MUSCULAR SUBSTANCE OF THE HEART.

Dilatation of the Heart—Dilatatio Cordis.

GY. *Dilatation of the heart* may involve only a single one ties or the entire organ. It is most conspicuous either in the r in the right ventricle, on account of their inferior provision ular fibres. It may be produced *mechanically*, through an f blood pressure that is consequent upon obstruction to the ; or it may be the consequence of *deficient nutrition;* or it t from *both causes*. The worst forms of mechanical dilatation cur as a consequence of valvular diseases of the heart, *e. g.*, ion of the left ventricle that follows insufficiency of the aortic the dilatation of the right side of the heart and of the left t occurs in cases of insufficiency of the mitral valve. Such is usually accompanied by hypertrophy of the affected por- he organ, but when it occurs in feeble, sickly, or elderly uch compensatory hypertrophy may fail to be developed.

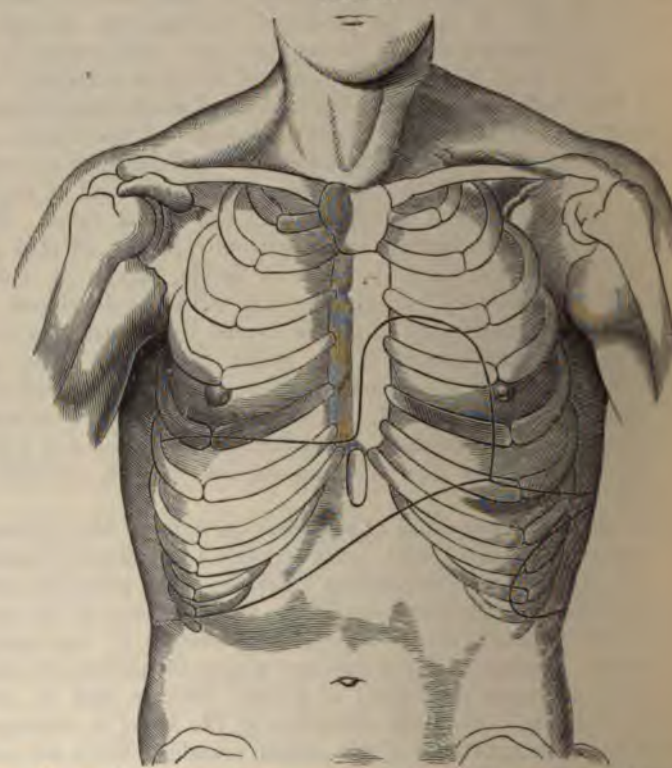
ion and hypertrophy that are caused by *disease of a single lve*, *e. g.*, insufficiency of the aortic valve, may affect only of the heart, *e. g.*, the left ventricle; but when several or all diac valves are diseased, the entire organ becomes enlarged, times, reaches enormous dimensions, rivalling those of a bull's ence the epithet *Cor bovinum* applied to such examples of hy.

vious that every cause of *persistent increase of blood pressure* ta or pulmonary artery, must occasion a mechanical dilatation trophy of the corresponding ventricle. The principal causes ed pressure in the aortic circulation are aneurisms of the aorta, n of its trunk, arterio-sclerosis, contraction of the kidneys, ancy. Increased blood pressure within the pulmonary artery efly in chronic pulmonary or pleural diseases, and in caries al column. *Nutritive dilatation of the heart* is consequent ges in the substance of the cardiac muscle. These are some- a transitory character and admit of recovery. Such are the that accompany *fever*, by which the right ventricle is tem- ilated. Similar conditions are observed in connection with *ve diseases*, even in the absence of fever, as a consequence of y of the specific poisons that are generated by microbic infec- nilar dilatation also testifies to the *defective nutrition* that is chlorosis, or by chronic diseases, disturbances of digestion, ted losses of blood. It may result also from the poisonous lkalies, or mineral acids; and it has been observed to occur continued excessive muscular exertion on the part of delicate individuals.

Dilatation of the heart may be produced by local causes that *interfere with the nutrition of its muscular substance*, such as fatty degeneration, and inflammation of the myocardium. Constriction of the coronary arteries and veins, and pericarditis, may lead to a similar condition.

PATHOLOGICAL ANATOMY. Uncomplicated *dilatation of the heart* is easily recognized by the enlargement of its cavities, and by the increased thinness of their walls. Dilatation of a single ventricle may produce such a change in the size and form of the heart that the other undilated portions may appear like mere appendages of the enlarged portion. When the entire organ is affected it loses its conical form

FIG. 115.



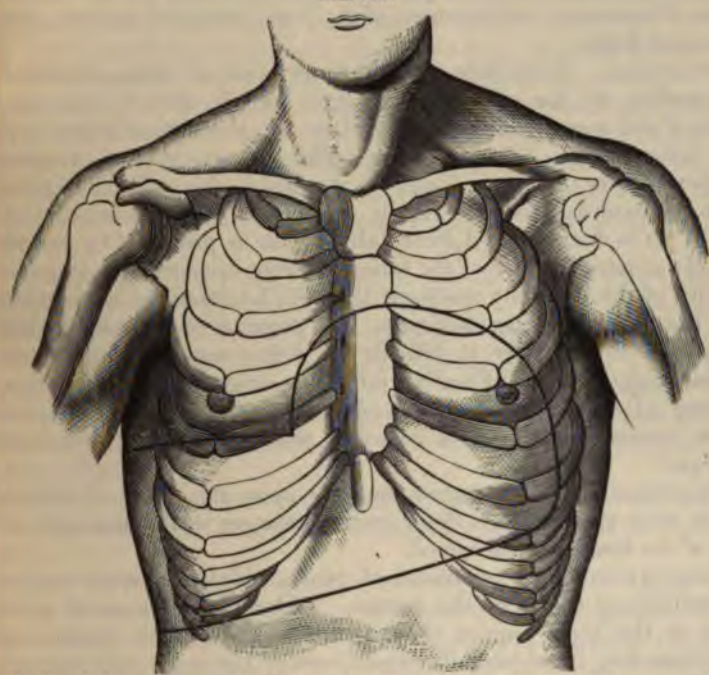
Area of normal percussion dulness of heart, liver, and spleen. (Slightly modified from WEIL.)

and assumes that of a rounded pouch. On opening the heart, its tissues appear relaxed, and the ventricular walls collapse upon themselves like fragments of wet chamois skin. In certain cases the muscular fibres of the auricles have been so widely stretched apart that the endocardium is almost in contact with the pericardium. The muscular substance of the organ is pale and sometimes friable; and its fibres may be fatty, waxy, or merely granular in structure, or they may exhibit no special degeneration.

Post-mortem dilatation of the heart may be distinguished from uine cardiac dilatation by the presence of post-mortem discoloration he endocardium through imbibition of hæmoglobin, and by the fact t such dilatation generally occurs after death from chronic diseases the respiratory organs, or from suffocation. In such cases the ht side of the heart is over-distended with blood, and contracts ickly after its contents have been removed.

SYMPTOMS. The symptoms of *cardiac dilatation* are principally nected with the local physical signs of increase in the dimensions of organ. (Fig. 115.) When the *left ventricle alone is dilated*, the area of lness is extended downward as far as the sixth or seventh intercostal

FIG. 116.



Cardiac dulness increased from hypertrophy of both ventricles. (FINLAYSON.)

ace, outward, sometimes, beyond the left mammary line, and upward as as the second rib, instead of being limited by the third rib. The apex at may be felt over a wider space than common, and the force of its pulse is considerably diminished. The pulse at the wrist also exits a corresponding reduction of vigor.

Dilatation of the right ventricle causes an extension of dulness beind the right border of the sternum, sometimes to a distance of an h or more at the level of the fourth costal cartilage, especially if the ht auricle, as well as the ventricle, be dilated. *Dilatation of the tire heart* produces an extension of cardiac dulness in all directions. g. 116.)

The *cardiac sounds* are considerably diminished, and are sometimes associated with systolic murmurs. The *movements of the heart* often exhibit uncommon rapidity that is sometimes connected with difficulty of breathing or with palpitation and pain. The veins are distended, while the arteries contain less than the normal amount of blood, conditions which tend to produce syncope by reason of cerebral anæmia.

The *duration of the disease* depends upon the nature of its cause; the dilatation that is associated with febrile states of the system recovers rapidly and completely, sometimes within a few hours. But if the changes in the muscular substance of the heart are permanent, the phenomena of circulatory obstruction soon appear; the jugular veins dilate and often pulsate; cyanosis appears; and, presently, more serious phenomena are developed, *e. g.*, œdema, reduction in the amount of the urine, albuminuria, enlargement of the liver, bronchial catarrh, hæmoptysis, and death.

Diagnosis. *Dilatation of the heart* must be distinguished from *pericarditis* by the absence of friction sounds, and by the peculiar figure of the area of dulness, as well as by the characteristic impulse that accompanies the apex beat. The change in the extension of cardiac dulness that is produced by changes in the position of the body when pericarditis exists, is hardly ever observed in dilatation of the heart. It is distinguished from dulness that is produced by *exudation into the anterior border of the lungs*, or from *encysted pleurisy* in the vicinity of the heart, by the signs that will be described in connection with the diagnosis of pericarditis. The presence of *thoracic aneurisms* or *tumors* may render it difficult to define accurately the limits of cardiac enlargement. Finally, dilatation may be concealed by *pulmonary adhesions*, or by an *emphysematous condition of the lungs*, which prevent the heart from crowding those organs aside as it becomes enlarged.

Prognosis. The prognosis depends upon the cause of dilatation, and is most serious when degenerative changes in the muscular structure of the heart have occurred.

Treatment. The treatment of cardiac dilatation must conform to the underlying causes of the disease. Chlorosis and general enfeeblement of the body require the administration of iron, tonics, and a nutritious diet, in which milk should occupy the most important place. Febrile conditions require the ordinary treatment with cold baths and the administration of febrifuge remedies, in order to reduce the temperature by which the integrity of the cardiac tissues is threatened. Frequent pulsations of the heart should be reduced by the application of ice-bags over the cardiac region, and by the cautious use of digitalis or its substitutes. In all cases, rest, and the avoidance of excessive muscular exertion, must be enjoined.

Hypertrophy of the Heart—Hypertrophia Cordis.

Pathological Anatomy. *Hypertrophy of the heart* consists in an increase of the muscular tissue of the organ. This may be produced either by an enlargement of the individual muscular fibres or by increase of their

ıber. Both conditions may be associated. The principal sign of ertrophy of the heart is presented by an extraordinary thickening ts walls. This is almost invariably accompanied by a dilatation he cavities with great enlargement of the entire organ, constituting t is termed *excentric hypertrophy of the heart.*

t occasionally happens that hypertrophy of the cardiac muscle exists hout enlargement of the enclosed cavities, and they may seem to be n actually diminished in size. This is termed *concentric hypertrophy of the heart*, and by some authors is thought to be a consequence sudden development of rigor mortis during systolic contraction of the pertrophied heart. This condition must be at all events distinguished m the contracted condition of the heart that is observed after death m sudden evacuation of the liquids of the body, such as occurs during olera, or in the beheading of a criminal.

The term *simple hypertrophy* is applied to cases that are marked by pertrophy without concomitant dilatation of the heart spaces.

Hypertrophy of the heart produces an unusual firmness and solidity its structure. The muscular substance often exhibits no change in lor, but sometimes it is unusually dark and pigmented. Sometimes lated muscular fibres, or groups of fibres, exhibit evidence of fatty generation. This condition indicates the existence of incipient cardiac failure.

The process of hypertrophy does not always involve the entire heart; may be either total, partial, or circumscribed. *Partial hypertrophy* volves only a single division of the organ; *circumscribed hypertrophy* ay be restricted to a single papillary muscle, or to the ventricular ptum, or to the auricular appendices, or the conus arteriosus. The ft ventricle is the common seat of hypertrophy; the right side of the eart is more liable to dilatation without hypertrophy by reason of its uscular inferiority.

The increase of space that is occupied by the heart within the thorax as been already sufficiently indicated in the description of cardiac ilatation.

Etiology. *Hypertrophy of the heart* occurs when the organ performs an extraordinary amount of labor without diminution of its utritive supply. In the majority of cases the increase of cardiac function occasioned by *obstruction of the circulation* of the blood. This may e caused, so far as the left ventricle is concerned, either by disease of he aortic valve, or by constriction of the aorta, which may result from ongenital causes; or from insufficiency of the mitral valve; or from he pressure exercised by neighboring tumors; or by aneurismal or ther dilatation of the aorta or its principal branches; or by diseases of he vascular walls which interfere with their elasticity. It may also be he result of pregnancy, though some authors have endeavored to show hat the apparent enlargement of the organ during the reproductive ffort, is caused by upward pressure of the diaphragm that crowds the eart out of its normal position, and produces a fictitious semblance of ypertrophy.

Hypertrophy of the left ventricle is observed frequently in contracted tates of the kidney. It may also occur in acute or chronic nephritis,

or in connection with renal calculi and hydronephrosis, probably because the blood becomes overcharged with excrementitious substances that excite the hypertrophic process in the muscular structure of the heart.

Hypertrophy of the right ventricle may be occasioned by anything that hinders the passage of blood from the right ventricle through the lungs, *e. g.*, diseases of the pulmonary valve; constrictions of the pulmonary artery by reason of tumors, aneurisms, or arterio-sclerosis; chronic diseases of the pleura or of the lungs, which produce compression or obliteration of the pulmonary capillaries. Cardiac hypertrophy rarely occurs during the course of pulmonary tuberculosis, because the degree of cachexia is so great as to interfere with the nutrition of the muscular substance of the heart.

An *enlargement of the entire heart* is observed when the causes that produce hypertrophy of its different portions are simultaneously associated. This is frequently observed in valvular disease, and it may be produced by pericarditis and by myocarditis. It sometimes occurs as a consequence of excessively frequent movements of the heart, such as are exhibited by nervous persons who suffer with palpitation, followed by gradual enlargement of the heart. A similar change often accompanies exophthalmic goitre. It is not uncommon among plethoric persons who indulge in excessive eating and drinking. It may in like manner be produced by toxæmic conditions connected with the abuse of tea, coffee, tobacco and alcohol, or the introduction of lead into the circulation.

Besides the cases just mentioned there are many for which no apparent cause can be discovered. These are termed cases of *primary or idiopathic hypertrophy of the heart.* They are generally dependent upon long-continued and excessive muscular exertion, and are encountered chiefly among the laboring classes.

Symptoms. The symptoms which are connected with the exciting causes of cardiac hypertrophy must be distinguished from the physical signs that are produced by the enlargement of the organ. The diagnosis depends upon the physical signs of enlargement of the entire organ, or such portions as may have undergone change in partial hypertrophy. In *hypertrophy of the left ventricle*, the præcordial region is considerably prominent, especially in the case of women or children whose ribs are yielding. The apex beat is extraordinarily vigorous, and the pulsatory impulse is not limited to the point of contact with the thoracic wall, but is diffused over the greater portion of the left side of the chest; in some cases the whole body and the bed upon which the patient lies participate in the systolic impulse. The apex beat is most distinctly seen and felt to the left and downward. Sometimes a short, diastolic, aortic impulse is felt in the second intercostal space upon the right side of the sternum, alternately with the systolic apex beat. Auscultation indicates a state of increased tension in the aortic valve during diastole, producing an accentuation of the second sound over that valve. The carotid arteries and their branches beat with increased force, which sometimes produces a systolic murmur that is audible over their course as a consequence of

essive tension and vibration of the arterial walls. The pulse at the st exhibits increased force and tension.

Subjective symptoms may be either entirely absent, or may be limited the occasion of excessive muscular exertion, when palpitation and rtness of breath are not uncommon. Sometimes a feeling of con- ction or pressure is manifested in the cardiac region, and may be ompanied by pain extending into the left arm. Usually it becomes icult or impossible to lie upon the left side; sometimes there are dences of cerebral congestion, *e. g.*, dizziness, pressure in the head, shes of light before the eyes, humming sounds in the ears, or a sub- tive sensation of audible pulsation in the head. Epistaxis is not common, and if the cerebral vessels are diseased hemorrhage may ur within the cranium. Female patients sometimes suffer with pro- e menstruation.

Hypertrophy of the right ventricle is indicated by the diffusion of diac impulse toward the right, where it becomes visible over the er portion of the sternum. Auscultation indicates the usual increase diastolic sound at the entrance of the pulmonary artery.

Hypertrophy of the right side of the heart is liable to association th cyanosis, shortness of breath, and bronchial catarrh, or even morrhages of the air passages. *Hypertrophy of the entire heart* is dicated by the coexistence of the symptoms and signs that indicate largement of the different portions of the organ.

So long as the muscular substance of the heart preserves its nutritive tegrity the patient may enjoy a considerable degree of health, but en nutrition fails and muscular degeneration begins, the symptoms *circulatory obstruction* appear, and life is terminated after a period greater or less duration, characterized by the occurrence of dyspnœa, lpitation, irregular and frequently rapid pulse, œdema, diminution of ine, sometimes associated with albuminuria, enlargement of the liver, opsy, cough, hæmoptysis, and asphyxia. Sometimes death is pre- ded by cerebral symptoms terminating in coma and convulsions.

TREATMENT. Since hypertrophy of the heart is the natural means which compensation for circulatory obstruction is effected, the treat- ent must have for its object the accomplishment of hypertrophy and e prevention of degeneration in the muscular tissue of the heart. his cannot be accomplished by the administration of drugs, but a favor- ble result must be reached through the employment of proper dietetic nd hygienic measures. Violent exercise and cold baths must be for- idden, though cold sponging, night and morning, has a favorable ffect. Coffee, tea, and tobacco must be forbidden on account of their ritating effects upon the heart. The diet must consist of easily gested substances such as milk, eggs, broths, lean and tender meat, ith stewed fruit and such vegetables as do not cause indigestion with e development of gas in the stomach and intestines by which the iaphragm may be crowded against the heart. Fats and starches ould be avoided. Beer and light wines may be recommended in deration in cases that are characterized by imperfect nutrition, but y must be refused to plethoric patients, for whom may be prescribed th advantage a milk cure or grape cure. Constipated conditions of

the bowels must be prevented; palpitation may be obviated by the recumbent position and by the application of an ice-bag over the heart. Counter-irritation produces little or no effect. Symptoms of heart failure call for the cautious use of digitalis or its substitutes.

Atrophy of the Heart—Atrophia Cordis.

Atrophy of the heart has been observed as a consequence of senile changes, or cachectic conditions, or as a result of pressure exerted by mediastinal tumors, or chronic pericardial exudations, or constrictions of the coronary arteries. It is a condition that can scarcely admit of recognition with certainty before death, nor does it require any special treatment besides what is indicated by existing states of general prostration and debility.

Fatty Heart—Cor Adiposum.

Pathological Anatomy. This disease consists in an excessive increase of the fat which naturally exists about the base of the heart and the large vessels. It sometimes envelops the entire organ with an adipose mantle nearly an inch in thickness. It occasionally invades the connective tissue beneath the epicardium, and separates the muscular fibres in the ventricular walls. In addition to this, the *individual muscular fibres may undergo fatty degeneration*, by which the muscular substance of the heart is still further weakened. The *coronary arteries* and the *aorta* also may sometimes exhibit evidence of endarteritis.

Etiology. In the majority of cases, *fatty heart* is the local exhibition of a general *tendency to obesity* which is exhibited by intemperate persons and high livers who consume too great a quantity of starchy and saccharine food. *Hereditary predisposition* sometimes exists, and it is more commonly observed among men than among women, especially after the fortieth year has been passed. Among women it is sometimes observed, apparently as a consequence of amenorrhœa and sterility, or after childbirth and the turn of life.

The *fatty heart of anæmia* occurs as a consequence of a reduction in the oxygen-carrying power of the blood, such as is observed after hemorrhages, and during conditions of cachexia that accompany chlorosis, phthisis, cancer, scrofula, Addison's disease, etc.

Symptoms. It often happens that the existence of superfluous fat about the heart is only discovered after death. In other cases a sudden death without previous notable symptoms first attracts attention to the condition of the individual. In still other cases, the symptoms are those that characterize an enfeebled condition of the heart, by reason of which the circulation of blood is imperfectly performed. But, as none of these symptoms possess a diagnostic character, it is generally necessary to consider the history of the patient with reference to excesses at the table. The existence of obesity is also favorable to the diagnosis of a fatty heart. The occurrence of an *arcus senilis*, indicating a fatty degeneration along the border of the cornea, possesses

e degree of significance, though it is a not uncommon occurrence
ng elderly people who do not accumulate fat in the subcutaneous
nective tissue.

Enfeeblement of the heart is sometimes suddenly manifested after
ent exertion of any kind, and becomes more and more developed
the progress of the disease. Its principal signs are excessive
tention of the veins and a scanty flow of blood through the arteries.
e cardiac impulse appears weakened, or even absent. Percussion
erally indicates an extension of cardiac dulness. The heart sounds
their force, and a systolic murmur frequently accompanies the first
tricular sound. In many cases the rhythm of the cardiac sounds is
urbed by the substitution of a succession of beats with uniform in-
rals, like the galloping of a horse (bruit de galop—Galopprhythmus).
e pulse at the wrist is small, weak, and often irregular. The periph-
l arteries are frequently calcified or sclerosed.

Palpitation is not uncommon, either with or without previous physi-
or mental excitement. It is sometimes accompanied by pain about
heart and extending into the left shoulder and arm. Sometimes
se cases exhibit great difficulty of respiration, with copious perspira-
n and fall of temperature, forming a picture very similar to that of
hma. Hence the term *cardiac asthma*, that has been connected
h them.

Prominent among the symptoms of fatty heart have been described
reat retardation of the pulse, pseudo-apoplectic seizures, and Cheyne-
kes' respiration. The reduction of the pulse sometimes falls as low
eight or ten beats during a minute. It is the consequence of cere-
l anæmia and irritation of the inhibitory centre in the medulla
longata.

Pseudo-apoplectic attacks exhibit a superficial resemblance to
uine paralytic strokes; but the patients recover rapidly, sometimes
the course of a few minutes, and paralytic symptoms are either
sent or continue for a few hours only. These attacks are sometimes
newed many times in the course of a day, or they may occur at inter-
ls during many weeks or months. Their incidence is frequently
thout warning, though patients sometimes feel a premonition of their
proach. They are principally dependent upon a condition of cere-
l anæmia, and frequently may be averted by lowering the head
low the level of the body. They are generally associated with
anges in the beat of the pulse and disturbances of the respiration,
d are sometimes accompanied by spasmodic contractions of the
uscles in the limbs.

Cheyne-Stokes' respiration consists in a series of twenty or thirty
spirations, at first shallow, then becoming deeper and deeper, and
suming the characteristics of asphyxia, followed by a pause of one-
lf or three-quarters of a minute, during which respiration is entirely
spended, after which the cycle is again renewed. (Fig. 117.) Slight
al spasms sometimes appear toward the close of the respiratory
use; this symptom is frequently observed in connection with the
oplectiform attacks, and is especially common after the use of

Acute Inflammation of the Heart—Myocarditis Acuta.

Acute diffuse inflammation of the cardiac parenchyma is characterized by granular degeneration of the swollen muscular fibres, with increase in the number of their nuclei. In severe cases the process results in fatty degeneration of the muscular fibres. These processes generally have their origin in the toxæmic conditions that accompany infective diseases.

Acute diffuse interstitial myocarditis depends in like manner upon constitutional infection involving the connective tissue of the cardiac muscle, which becomes infiltrated with round cells.

Acute circumscribed myocarditis is usually the result of infective embolic processes in the branches of the coronary arteries, by which are produced numerous abscesses in the substance of the myocardium. It is, like other forms of myocarditis, the result of infective diseases, and of ulcerative endocarditis. The number and size of the abscesses may be very considerable. Large abscesses, containing sometimes nearly an ounce of pus, may interfere considerably with the function of the heart. The purulent contents of a myocardial abscess may become encysted, or caseous, and, finally, calcified. Rupture of the abscess into the pericardium, or into one of the cavities of the heart, may take place. The pus that finds its way into the current of the blood traverses the entire arterial system, and may excite embolic processes of an infective character in any part of the body. By the pressure of blood into the cavity of such an abscess, when it communicates with an endocardial cavity, the external wall of the abscess will be subjected to pressure, with the formation of an acute cardiac aneurism as its result. Such aneurisms expose the patient to great danger through their rapid growth and sudden rupture. Abscesses that are formed in the neighborhood of the auriculo-ventricular valve may produce insufficiency of those valves as a result of the processes that accompany their formation. Sometimes an abscess may burrow through the septum between the ventricles, opening a communication between different cavities upon opposite sides of the heart, with consequent disturbances of the circulation of the blood.

Chronic Inflammation of the Heart—Myocarditis Chronica.

Pathological Anatomy.—*Chronic myocarditis* consists in the gradual development of inflammatory induration in the connective tissue of the heart. The callosities which are thus produced appear in the form of gray patches, or streaks, imbedded among the muscular fibres; and, sometimes, associated with them are fibres of the muscular tissue that have undergone fatty degeneration. These spots of indurated tissue may be exceedingly minute, or they may form hard and gristly masses, one or two inches in diameter. They are found, most frequently, in the wall of the left ventricle, near the apex, or in the septum between the ventricles. When formed during fœtal life, they occur usually in the right ventricle.

Chronic myocarditis is usually associated with *chronic endocardial*

Lammation and with *hypertrophy* of such portions of the cardiac scle as have escaped degeneration. The intima of the coronary eries may undergo chronic inflammation, with consequent thrombosis d the production of infarcts in the muscular substance. If the papil- y muscles become indurated, their function is unfavorably affected, d the phenomena of valvular insufficiency will appear. Indura- n of the connective tissue in the conus arteriosus of either ventricle, duces constriction and the occurrence of many of the symptoms of nosis of the arterial valves of the heart. Sometimes an indurated t in the ventricular wall gradually yields to endocardial pressure, h the consequent development of a *cardiac aneurism*. In the jority of cases these aneurismal tumors spring from the left ventricle, ar its apex. They have been known to reach the size of a man's ad, forming a tumor that fills the whole left side of the thorax.

ETIOLOGY. *Chronic myocarditis* may be produced by exposure to ld, by injuries of the thorax, by violent exertion, by excesses in the e of alcohol or tobacco, by lead poisoning, by infection with the uses of acute rheumatism, malaria, and syphilis. It may result from ut and diabetes; and is often associated with diseases of the coronary teries, and with chronic nephritis, especially with the contracting rm of that inflammation. Inflammation of the endocardium, or of the ricardium, may lead to myocarditis through the extension of the flammatory process to the tissues of the myocardium. The disease is ore common among men than among women, and is especially fre- ent after middle life.

SYMPTOMS. *Slight forms of myocarditis* produce no perceptible nsequences. *Severe cases* present symptoms that are sufficiently ident, though destitute of diagnostic value. Progressive diminution cardiac power is one of the most specific symptoms. There is com- laint of palpitation and shortness of breath after slight exertion; metimes associated with pain in the cardiac region and in the left rm, or extending into the epigastrium and abdominal cavity. Cardiac pulses and sounds are exceedingly weak, and the first ventricular ound is sometimes replaced by a systolic murmur. The *bruit de galop* sometimes audible, the pulse is often intermittent, and, sometimes, ery much retarded. Swelling of the cervical veins, cyanosis, catarrh f the respiratory passages, and disorders of digestion very frequently ccur. The symptoms of circulatory obstruction finally appear, with a tal result. Death sometimes occurs very suddenly.

PROGNOSIS. The prognosis of *chronic myocarditis* is always very rave. The most favorable cases are those which have been originated y syphilis, since they may yield to specific treatment.

TREATMENT. Perfect rest of mind and body, with proper diet, are f the utmost importance. Rapid and irregular movements of the eart may be controlled by ice-bags upon the chest; the appearance of mptoms that indicate cardiac failure is the signal for the employment digitalis or its substitutes. Syphilitic cases may be treated with ily inunctions of mercurial ointment during the period of a month. dide of potassium in doses of five to ten grains three times a day, or

a pill containing one-fourth of a grain of the proto-iodide of mercury three times a day, will be found useful.

Rupture of the Heart—Cardiorrhexis Spontanea.

ETIOLOGY. *Spontaneous rupture of the heart* only occurs as a consequence of previous degeneration of its muscular structure. This most frequently depends upon *diseases of the coronary arteries* which may lead to embolic or thrombotic processes, or may be associated with abscesses and softening of the heart. Chronic myocarditis, fatty heart, cardiac tumors, the development of parasites in the cardiac substance, and diseases of the cardiac valves, may all be followed by degeneration and rupture of the organ.

Rupture of the heart is a *disease of old age*, usually occurring after the sixtieth year of life; and is more frequent among males than among females. It is occasioned, generally, by some form of violent muscular action, though it may occur during sleep, or in conditions of perfect repose.

PATHOLOGICAL ANATOMY. *Rupture of the heart* may be *total* when it produces a solution of continuity in the entire thickness of the cardiac wall. It is *partial* when it involves only a few muscular fibres, or the papillary muscles, or trabeculæ of the ventricles, by which the attachments of the chordæ tendineæ are released and the phenomena of valvular insufficiency are produced.

Total rupture of the heart usually occurs through the wall of the left ventricle, near the apex; next in frequency is the rupture of the right ventricle; then, through the right auricle; and, rarest of all, through the left auricle. The rent is generally irregular and parallel with the course of the muscular fibres, which are partly torn and partly separated from one another. After death the fissure is found to be occupied with clotted blood, which also occupies the pericardial cavity, sometimes in great quantity. When adhesive pericarditis has previously obliterated the pericardial space the blood may find its way into the pleural cavity or along the trunks of the large arteries.

SYMPTOMS. *Sudden death* is the frequent consequence of rupture of the heart, but sometimes the symptoms are prolonged for a number of hours. There may be complaint of agonizing pain in the heart, the face grows pale, and the temperature of the body falls. The pulse becomes rapid and almost imperceptible. The skin is covered with cold and clammy sweat; complete collapse occurs, and death follows. Sometimes vomiting and purging, like that of cholera, are experienced. This may be the result of cerebral anæmia, with consequent irritation of the roots of the vagus nerve, or it may be the result of direct irritation of its cardiac branches. The usual phenomena of syncope, sometimes culminating in convulsions and death, may also occur as a result of cerebral anæmia. The physical signs of cardiac failure—weakness or suppression of sounds and impulse—are present. Excessive effusion of blood into the pericardium will cause an extension of the area of cardiac dulness.

The *immediate cause of death* is connected either with cardiac

ralysis, or with cerebral anæmia, or as a direct consequence of ock.

DIAGNOSIS. Obviously the diagnosis of *rupture* can be only of inferential character. Tolerable certainty is acquired when increas- heart failure is associated with the symptoms of internal hemor- age and rapid extension of the area of cardiac dulness.

TREATMENT. Prophylactic treatment consists in the avoidance of ery cause of excitement and over-exertion. If rupture of the heart suspected the patient must be placed in the horizontal position, and hypodermic injection of fifteen drops of ergotine, diluted with an ual quantity of water, may be made into the thoracic wall near the art. Cardiac stimulants, *e. g.*, wine, ether, camphor, musk, may be ministered. If life be prolonged, digitalis, in tablespoonful doses of e infusion, may be administered every two hours, for the purpose invigorating and regulating the action of the heart.

Tumors of the Heart—Neoplasmata Cordis.

Tumors involving the muscular structure of the heart seldom exist. nless they acquire considerable dimensions they cannot be recognized, at sometimes they may interfere with the nutrition of the muscular bres to an extent that weakens the organ, or they may obstruct the ction of the cardiac valves, with production of corresponding symp- ms. Detachment of portions of their substance may excite embolic rocesses in remote parts of the body. Sudden death may thus be aused by obstruction of the aorta or pulmonary artery.

Parasites.

Cysticercus cellulosæ, Pentastomum denticulatum, and Echinococcus ometimes invade the muscular substance of the heart. Only Echino- coccus cysts produce any serious disturbance. They are associated with the existence of similar parasitic structures in other organs. They may be as small as the head of a pin, or they may reach the size of an orange, and their number is sometimes very considerable. Their effects are produced by mechanical interference with the functions of the heart or by the detachment of embolic cysts by which distant arteries are obstructed.

Misplacement of the Heart—Dislocatio Cordis.

Among the ante-natal defects that sometimes attend fœtal develop- ment may be mentioned *misplacement of the heart into the right side of the thorax;* sometimes associated with universal transposition of the thoracic and abdominal organs. In other cases the heart retains its fœtal position in the median line. These congenital defects are very apt to be associated with disposition to valvular disease. Sometimes there is partial or total absence of the sternum, so that the heart can be felt as a pulsating tumor immediately beneath the skin, a condition that is not incompatible with long life. In other cases the skin also is deficient, so that the heart lies completely exposed to view. This con-

dition constitutes what is termed *ectopia cordis*. Sometimes the heart is discovered *within the abdominal cavity*, and it has been known to occupy the cavity of an *umbilical hernia*. In other cases, it has been displaced, in the course of development, in an upward direction, so as to occupy a position in the *upper part of the thorax*, or even *in the neck*.

Like the kidney, the heart sometimes exhibits such laxity in its connection with adjacent organs and structures that it may be described as a *floating heart*, a condition of things which generally occurs in cases of obesity after the removal of fat from the vicinity of the heart by excessive therapeutic activity which has deprived the organ of its previous supports.

Diseases of the Coronary Arteries.

Experimental investigation has shown that *ligature or obstruction of the coronary arteries* upon the *lower animals* produces irregularity or complete arrest of the movements of the heart. In this way may be explained cases of sudden death, which, on post-mortem examination, exhibit nothing but an atheromatous and constricted condition of the coronary arteries. Insufficiency of cardiac vigor, asthmatic difficulty of respiration, and obstruction of the circulation, are not uncommon consequences of *arterio-sclerosis affecting the coronary arteries*. Hemorrhagic infarcts, muscular degeneration, and rupture of the heart, sometimes follow upon coronary disease. Myocarditis with induration of the connective tissue of the organ, and the production of various modifications in the walls of the heart or in its valves, may all be associated with these changes, which, moreover, may also involve the aorta and its branches, even as far as the kidneys. Coronary disease is associated with the degenerative processes of old age. It is more common among males than among females, and is often dependent upon gout, syphilis and alcoholism.

CHAPTER III.

NEUROSES OF THE HEART.

Paroxysmal Tachycardia—Palpitation of the Heart—Tachycardia Paroxysmalis.

ETIOLOGY. *Tachycardia* is an abnormally frequent and forcible action of the heart, occurring in paroxysms that alternate with a healthy movement of the organ. It does not include those conditions of palpitation which occur in connection with valvular diseases and obstruction of the circulation. Two forms of the disease may be distinguished: 1. Nervous palpitation. 2. Toxic palpitation.

1. The *nervous form of the disease* is dependent upon cerebral excitement of a depressing character, *e.g.*, fright, grief, worry, etc.; or

may be produced by nervous exhaustion dependent upon sexual cesses, chlorosis, loss of blood, prolonged lactation, excessive labor, steria, and neurasthenia. It is sometimes dependent upon actual sease of the brain or spinal cord, or upon tumors that exert pressure on the roots or trunk of the pneumogastric nerve. Diseases of the gestive organs, errors of diet, constipated conditions of the bowels, testinal parasites, hemorrhoidal disorders, gall-stones, renal calculi, erine and ovarian disorders, have all been enumerated among the uses of cardiac palpitation.

2. The *toxic form of tachycardia* comprises such cases as are pendent upon the introduction of morbid poisons into the circulation, upon the retention of excrementitious matters. Tea, coffee, tobacco, cohol, and various drugs like hemlock and henbane, are common uses of the disease. It is not unfrequent among the victims of gout. The disease occurs among children as well as among adults. Ex- ssive ambition in the pursuit of education, a rapid and slender owth of the body, and the occurrence of indigestion or intestinal rasites favor the manifestation of the disease in early life.

The connection of the heart with the sympathetic and pneumogastric erves indicates that palpitation may sometimes result from *irritation the first*, and, under other circumstances, from *temporary enfeeble- ent of the second.*

SYMPTOMS. The principal symptom of paroxysmal tachycardia is rnished by the occurrence of *attacks of palpitation* in which the umber and, usually, the force of the cardiac pulsations is increased. uch paroxysms may continue for a few minutes only, or for a number f hours. They may be separated by many minutes, or they may ecur daily, or even many times a day. The disease may be limited y a single paroxysm, or it may continue through life.

The *paroxysm of palpitation* is preceded not unfrequently by sensa- ons of distress in the cardiac region. The heart may beat feebly, if about to cease from all motion. As the attack progresses there are nsations of pain, thoracic constriction, difficulty of respiration, companied by a feeling of anxiety; the countenance shows signs of stress, and is frequently covered with cold perspiration. Various mptoms of cerebral anæmia, accompanied by headache, are not common. The cardiac pulsations are often irregular, frequent, and rcible, with wide diffusion of impulse over the præcordial region. e systolic sound often assumes a metallic and vibratory quality that is casioned by synchronous oscillations in the thoracic wall. Sometimes e first sound of the heart can be heard at a distance from the thorax; is accompanied frequently by a murmur which continues during e paroxysm and is dependent upon the molecular vibrations in the rdiac muscle. The second sound of the heart often becomes weak and most imperceptible, and is accompanied by an imperfect filling of the teries. In other cases the cardiac impulse is forcible, the carotid teries beat vigorously, and there is complaint of a pressure of blood o the head.

If a paroxysm continue for any considerable period of time, the heart hibits signs of *exhaustion*, with retardation of the circulation; the

veins in the neck then become enlarged, and pulsate; the rapidity of the pulse may become very great, sometimes numbering 250 beats in a minute. Such impulses do not always fill the arteries; an intermission of the pulse at the wrist may then be observed.

Respiration is always more or less disturbed by reason of nervous irritation and irregular circulation of the blood through the lungs. The diaphragm is depressed, either though direct irritation of the phrenic nerves, or as a consequence of their reflex excitation. The voice is hoarse, husky, or even reduced to a whisper. Difficulty of respiration is generally increased by the horizontal position, and the patient seeks relief in the erect posture. Sometimes the act of swallowing is attended with difficulty, and there may be painful distention of the abdomen which sometimes is relieved suddenly by vomiting and by the discharge of flatus, followed by a speedy termination of the paroxysm. A similar copious discharge of urine generally follows the conclusion of the attack. A fatal termination is a rare occurrence, though the patient commonly feels depressed and anxious through fear of its repetition. An irritable condition of the heart sometimes becomes established, with consequent predisposition to the symptoms of the disease.

It sometimes happens that patients experience the *subjective sensations of palpitation* without any actual disturbance of the heart other than a slight irregularity of the pulse.

PATHOLOGICAL ANATOMY. The rarity of death from palpitation of the heart limits our knowledge of the changes that may accompany its manifestation. Dilatation and atrophy, with fatty degeneration and induration of the connective tissue, have been observed in a few cases.

DIAGNOSIS. The disease may easily be recognized by its symptoms. From the *rapid pulse that may accompany valvular disease* it can be differentiated by the absence of endocardial murmurs and dilatation with hypertrophy of the organ. When the murmur is present during an attack of simple tachycardia it is of the systolic character, and if it persists beyond the conclusion of the paroxysm it is probably of a chlorotic or anæmic origin. Cardiac disturbances that are dependent upon *chronic myocarditis* are less easy to distinguish from tachycardia. A differential diagnosis sometimes can be made only through long-continued observation of the patient and consideration of his antecedents.

PROGNOSIS. The prognosis will depend upon the nature of the cause. In many cases of a nervous character it may be easily removed, and the prospect of recovery is correspondingly good. Other cases depend upon incurable diseases, and admit of only temporary relief.

TREATMENT. The indications for treatment are twofold: to relieve the paroxysm and to prevent its recurrence. Upon the onset of an attack the patient should be placed in a spacious, well-ventilated apartment, and the clothing should be loosened, so as to permit easy respiration. Sometimes a paroxysm may be promptly aborted by some extraordinary measure, such as pressure upon some particular locality in the abdominal wall, or upon the pneumogastric nerve in the neck. Holding the breath after a deep inspiration, draughts of cold

ter, and sucking pieces of ice, sometimes give speedy relief. Some-
es an ice-bag over the heart is found useful; but it must not be for-
tten that some patients cannot tolerate cold, and are made worse
her than better by its application. The same thing must be re-
mbered in the recommendation of liquid nourishment; some patients
fer exceedingly hot drinks, others are relieved by cold lemonade,
rated waters, or iced champagne.

The first place among therapeutical remedies must be awarded to the
podermic use of morphine, of which a quarter of a grain may be in-
ted without the customary addition of atropine, since that drug
metimes occasions cardiac disturbance. Instead of morphine, other
rcotics may be used, *e. g*, opium, chloral hydrate, ether, cherry-
arel water, tincture of hyoscyamus, tincture of aconite, strychnine,
d ergot. Large doses of the bromide of potassium are sometimes use-
l. If the patient is of a nervous temperament, and is hysterically
clined, nervous stimulants may be employed, *e. g.*, tincture of vale-
an (℥ss every four hours), tr. assafœtida (℥ss every four hours),
loride of gold and sodium (℞. Auri et sod. chlorid., gr. v; ext. hyos-
am., ℈ij. M. Ft. pil. no. xxx. S.—One pill after each meal),
itrate of silver (℞. Argent. nitrat., gr. v; argill., q. s. ut ft. pil. no.
xx. S.—One pill three times a day), zinc. valerianat. (gr. j three
mes a day), Fowler's solution of potassium arsenite (four drops after
ch meal). Sometimes an emetic occasions immediate relief by evacu-
ting an overloaded stomach (℞. Apomorphiæ, gr. one-tenth, aq. des-
llat., ℥ss. M. S.—Inject hypodermically. ℞. Ant. pot. tart., gr. ss;
ulv. ipecac., sacch., āā gr. x. Div. in chart. no. iii. S.—Take one
owder every ten minutes till vomiting occur).

In order to avoid recurrence of tachycardiac paroxysms it will be
ecessary to consider their cause. The general health must be re-
tored by attention to diet and exercise in the open air, with massage,
nd cold sponging. If the heart seems to be in any way enfeebled, the
ong continued use of digitalis will be found useful (Fol. digital. pulv.,
ss.; ferri. carb. saccharat., ℥ijss; pulv. altheæ, q. s. ut ft. pil. no. l.
—Two pills after each meal.) Recently the cholëinate of sodium,
n doses of 1½ grains every two hours, has been recommended, when
igitalis fails to give relief. Change of occupation, and recreation at a
istance from home, often exercise a favorable influence. Anæmic and
hlorotic patients must be treated with iron and quinine. Hæmor-
hoidal subjects who have experienced a suppression of the customary
ischarge, will be greatly relieved by the application of a few leeches
round the anus. Female patients suffering with suppression of the
enses, in like manner obtain great relief from the application of
eches, or cups upon the inside of the thighs. Vermifuges, purga-
ves, and laxative mineral waters, will be found useful in appropriate
ses. When thereis functional weakness of the nervous system the
ily application of the galvanic current over the course of the pneumo-
astric nerve will prove advantageous; the positive pole should be
laced beneath the angle of the jaw, while the negative pole is applied
ower down for two or three minutes upon each side of the neck.

Paroxysmal Bradycardia—Bradycardia Paroxysmalis.

By the term *bradycardia* is indicated a condition the opposite of tachycardia. The movement of the heart is retarded in force and frequency. The pulse becomes small and weak, the skin is cool and pale, and there is complaint of dizziness and faintness, sometimes associated with loss of consciousness, local spasms, or epileptiform convulsions. The disorder is dependent upon nervous exhaustion, and is sometimes produced by the same causes that excite the phenomena of tachycardia in other patients. It is frequently associated with *polyarthritis* and with *fatty heart*, or with *sclerosis of the coronary arteries*. Similar retardation of the pulse is sometimes observed in the course of *exophthalmic goitre*, instead of the usual acceleration of the cardiac movement. It is most successfully treated with cardiac stimulants.

Intermittent Heart.

Cardiac pulsation may sometimes be suspended for several seconds. This may be distinguished from simple *irregularity of the heart* by the fact that the cardiac contractions are regular so long as they continue. Certain persons possess the power of voluntarily arresting the movements of the heart for a few seconds. This is supposed to be effected through the intervention of the nervous fibres that pass from the spinal accessory nerve to the pneumogastric trunk. These may be sufficiently excited by voluntary contraction of the cervical muscles to produce temporary arrest of the heart.

Intermission of the heart may be produced by diseases of the cardiac muscles, such as fatty degeneration and hypertrophy. It may also result from disease or exhaustion of the brain. It is not uncommon among elderly people after fatigue, especially if associated with imperfect elimination of the excrementitious products of metabolism.

Cardiac Neuralgia—Angina Pectoris—Stenocardia.

Symptoms.—This disease is characterized by *paroxysms of pain* which originate in the nerves of the heart and extend into other nervous tracts. In some cases the paroxysms occur without any apparent cause; in others they are preceded by indigestion, by excessive exertion of mind or body, or by exposure to cold. The onset of the attack is usually sudden, but sometimes it is preceded by various nervous disturbances that indicate derangement of the cerebral circulation, *e. g.*, dizziness, buzzing in the ears, flashes of light before the eyes, nausea, difficult deglutition, chilliness, formication, or change of color in the skin. The pain in the præcordial region is often intolerable and indescribable; it is accompanied by a feeling as if death were about to occur. Severe neuralgic sensations are also experienced in the form of irradiations of pain into the left shoulder and arm, sometimes extending along the tracts of the nerves as far as the tips of the fingers. It may also involve the nerves in the neck and scalp, and it may be felt sometimes in the epigastrium, in the abdomen, in the ovarian region, and along

course of the spermatic nerves. It sometimes reaches the lower tremities and the opposite half of the body.

The *movements of the heart* generally become accelerated, sometimes reased in strength, and sometimes enfeebled, with intermission of pulse. *Respiration* also becomes disturbed and difficult, though ere be no actual obstacle to inspiration or expiration. The counte- nce fully expresses the terrible agony experienced by the patient. *eal spasms*, sometimes reaching the height of epileptiform convul- ns, not infrequently occur. The territory of the pneumogastric rve is especially liable to such disturbances. The participation of *sympathetic nervous system* is shown by various *disturbances* of the *somotor* nerves.

During the attack there is often a great desire for fresh air. The tient leans out of the nearest window and seeks to press the thoracic ll against some firm support. The conclusion of the attack is gener- y accompanied by a copious discharge of clear and light-colored ine. If the paroxysm be considerably prolonged the signs of great ostration become apparent, and sometimes they may attain to the avity of apparent death.

The *duration of the paroxysm* is subject to great variation. Paroxysms ay follow one another only after long intervals, or they may recur equently for many days. The cessation of the paroxysm is some- mes very abrupt; in other cases it subsides gradually, with vomiting, acuation of the bowels, or copious discharge of flatus. Sometimes ere is cough and expectoration.

The alternation of the cardiac paroxysm with *paroxysms* of *other rms of neuralgia* has sometimes been observed, so that the physical xamination of the patient should not be limited to the heart, but hould embrace all the organs of the body. During the interval etween the paroxysms good health is frequently enjoyed, unless the redisposing cause be of a permanent character. Life is often pro- nged for many years, but death sometimes follows the gradual evelopment of marasmus or cardiac debility.

ETIOLOGY.—*Angina pectoris* is observed most frequently among old ople after their fiftieth year. It is a disease of males rather than of males, for the reason that men are more liable to gout, rheumatism, tty degeneration of the heart, and atheromatous degeneration of the odvessels, with which cardiac neuralgia is often associated. The e of tobacco and alcohol is also more common among men than ong women. Obesity and luxurious living are powerful predispos- g causes. Cold and damp weather is a frequent exciting cause of the sease.

Those cases of angina pectoris which occur without any recognizable ganic diseases of the internal organs constitute what is termed the *sential form of stenocardia*. All cases that are connected with ganic diseases that involve the circulatory apparatus are comprised der the term *symptomatic stenocardia*.

DIAGNOSIS.—*Angina pectoris* is easily recognized by attention to symptoms.

PROGNOSIS.—The prognosis depends upon the nature of the predisposing causes. It is favorable, when they admit of easy and permanent removal. It is always wise, however, to exercise great caution with regard to the future.

TREATMENT.—The general treatment of the paroxysm is the same that has been prescribed for the relief of tachycardia. The hypodermic injection of morphine frequently arrests the attack, though the danger which attends its use in cases that are dependent upon a fatty condition of the heart must not be forgotten. Inhalation of chloroform, which has been frequently practised, is a dangerous remedy, the use of which has been followed by epileptiform convulsions and collapse. Inhalation of amyl nitrite is attended with less danger, since it is supposed to stimulate the cerebral circulation. It may be poured in five-drop doses upon a handkerchief, from which it can be easily inhaled; on account of its explosive nature it should not be brought near a fire or a light. Nitro-glycerin, in drop doses of a one per cent. solution, may be given every few minutes until it produces effects similar to those of amyl nitrite. Cocaine hydrochlorate may be given, in doses of a third or a half of a grain, three or four times a day for two or three days. Its effect is more gradually developed than that of the preceding remedies. The hypodermic injection of antipyrine, in fifteen-grain doses, often gives great relief, sometimes even after the failure of morphine.

Symptoms of heart failure should be opposed by the use of cardiac stimulants. Mustard foot baths, and the application of mustard to the præcordial region, or the use of dry cups upon the thoracic surface, are very effectual.

Symptoms of vasomotor disturbance may be relieved by warm baths and by friction with chloroform liniment.

℞.—Tr. aconit. rad., Tr. belladon. aa ʒij.
Tr. g. camphor. ʒiss
Chloroform. ʒij
Lin. sapon. ʒvj —M.
S.—Apply externally.

A tendency to recurrence of the neuralgic paroxysm must be obviated by attention to the general health, *i. e.*, by regulation of the diet, daily movement of the bowels, exercise in the open air, massage, cold sponging, light gymnastics, and sufficient clothing to prevent the injurious effects of cold. Organic diseases must receive appropriate treatment. Galvanization of the sympathetic and pneumogastric nerves is also useful. Change of residence is beneficial when it can be procured without disagreeable sacrifices.

Exophthalmic Goitre—Tachycardia Strumosa Exophthalmica.

SYMPTOMS.—The prominent symptoms of exophthalmic goitre are an *increase* in the number of the *cardiac pulsations*, *swelling* of the *thyroid gland*, *protrusion* of the *eyeballs*, *tremor*, and *diminution of the cutaneous resistance to the galvanic current*. The pulsations sometimes rise to 150 or even 200 in a minute. They sometimes exhibit

smal acceleration associated with pain and subjective difficulty iration. In rare cases the movements of the heart are abnor- etarded. Dilatation and hypertrophy of the heart are occasion- served, as well as systolic murmurs, which are usually of a func- haracter; though sometimes chronic diseases of the heart may ciated with the neurosis.

leration of the heart often precedes *thyroid enlargement.* The s at first soft and compressible, sometimes exhibiting pulsatory ents; but, after a time, it becomes firmer and more consistent. teries and veins become dilated and serpentine. (Fig. 118.)

FIG. 118.



Exophthalmic goitre. (RUSH MEDICAL COLLEGE CLINIC.)

trusion of the eyeballs is usually one of the later symptoms of ease. It sometimes occurs upon one side only. Simultaneous pment of these symptoms sometimes occurs; but usually they l one another in a regular manner.

mor is sometimes partial and sometimes universal; it may be nt, or it may be manifested only during certain movements of the r limbs. The diminished resistance of the skin to galvanic cur- has been ascribed to an increase in the activity of the sweat

larger arteries throughout the body frequently exhibit an e of pulsation associated with various systolic murmurs. The *of the neck* not unfrequently pulsate. The force of the pulse s great variation.

eneral increase of glandular activity throughout the body is bserved, so that vomiting or profuse diarrhœa are not uncom- Hemorrhages from the various mucous membranes are sometimes d. As a consequence of perverted nutrition, the *skin* sometimes s discolored or thickened. Urticaria, vitiligo, sclerema, and ne of the lower extremities have all been observed.

victims of exophthalmic goitre are generally of a delicate con-

stitution, and of a blonde complexion. The countenance manifests an expression of astonishment, accompanied by a staring look, which is produced by the protrusion of the eyeballs, and by the fact that the upper eyelid does not reach the border of the cornea, but leaves a space in which the white, sclerotic coat of the eyeball is visible. Occasionally the protrusion of the eyeball is so great that the eyelids close behind instead of upon it; by reason of such exposure, inflammation and ulceration of the cornea not unfrequently occur. A symptom of considerable diagnostic importance lies in the fact that the movements of the upper eyelid do not coincide with changes in the position of the visual plane. This is due to a spasmodic contraction of the unstriated muscular fibres in the upper eyelid (Müller's muscle).

The disease is frequently observed among epileptic, hysterical, or hypochondriacal patients. Mental derangements sometimes occur, and an unusual cheerfulness is a not uncommon symptom.

Exophthalmic goitre is frequently associated with neuralgia of the cranial nerves. Hemi-anæsthesia, paræsthesia, chorea, ophthalmoplegia, and paralytic affections of the other cranial nerves, have been observed, as well as paralytic affections of the extremities. Progressive muscular atrophy and pseudo-muscular hypertrophy sometimes occur. The sensations of hunger and thirst are often greatly increased. The bodily temperature may be slightly elevated, and patients often complain of a subjective sensation of heat.

The disease usually develops gradually, and is of long duration. It is an uncommon thing for it to be introduced by a febrile attack. When recovery takes place the prominence of the eyeballs is the last symptom to disappear. Chronic cases usually fall into a condition of cachexia; sometimes the circulation suffers obstruction, and the phenomena of dropsy are developed. Intercurrent diseases are sometimes the cause of death.

ETIOLOGY. *Exophthalmic goitre* occurs about twice as often among women as among men, especially among delicate, blonde, blue-eyed, chlorotic, and anæmic persons who also suffer with nervous weakness and menstrual derangement. It is a disease of early adult life, occurring most frequently between the fifteenth and thirtieth years. Like other disorders of the nervous system, it is common among individuals who are descended from a neurotic ancestry. Unfavorable conditions of climate, occupation, and hygienic environment, concur with the effects of mental and physical exhaustion or previous disease, to favor the development of exophthalmic goitre.

PATHOLOGICAL ANATOMY. *Hypertrophy* and *dilatation*, *endocarditis*, and *fatty degeneration of the cardiac muscles*, have sometimes been discovered after death. The *connective tissue* and *parenchyma of the thyroid gland* are increased. Its arteries are dilated, and the veins are varicose. The *retro-bulbar tissues* are infiltrated with fat, and their bloodvesssels are dilated. The ocular muscles sometimes exhibit fatty degeneration. The *central nervous system* may, or may not, exhibit different changes which present no uniformity, and cannot be connected with the symptoms of the disease. The opinion of Charcot, that *exophthalmic goitre* is a *general neurosis*, comparable with

steria, expresses as accurately as any, the opinion of the majority of servers. Recent experiments upon lower animals, which indicate at many of the symptoms of the disease can be produced by irritation the restiform bodies, seem to favor the theory that the disease is the pression of a condition characterized by excitation of the accelerator rves of the heart and of the vaso-dilator nerves connected with the ssels of the head and neck. A similar excitation extending to the res of Müller's muscle and to the dilator fibres of the pupil may suf- e to explain the condition of the eyes.

DIAGNOSIS. The diagnosis cannot present any difficulty when all e symptoms are present. A persistently frequent pulse, that cannot explained by other causes, should lead to a suspicion of the imminent velopment of the disease.

PROGNOSIS. The prognosis is not very favorable. Sometimes pparent recovery is followed, after a considerable period, by a relapse. hen the disease occurs in the person of a male it is more unfavorable an in a patient of the opposite sex.

TREATMENT. The treatment of exophthalmic goitre is both local and eneral.

The general treatment must be directed to the improvement of the ealth and constitution of the patient. For this purpose may be recom- ended the long-continued administration of iodide of iron in the form f pills or of the syrup. The constant current, from five to ten battery ells, should be applied daily through the neck and upper part of the horax; the negative pole should be placed over the upper part of the eck, while the positive pole rests between the shoulder-blades. The egative pole may also be placed over the thyroid gland and along the ourse of the sterno-cleido-mastoid muscles. The current should be llowed to pass for two minutes in each position.

If menstrual derangements exist they should be regulated by appro- priate measures; and amenorrhœa must be overcome by the employ- ment of mustard foot-baths, with leeches, or cupping-glasses, upon the nsides of the thighs. Marriage has sometimes been observed to xercise a favorable effect upon the course of the disease. Long- ontinued daily massage is also of great value. Change of locality nd the use of mineral waters that contain iron, are frequently beneficial. Distressing palpitation of the heart may be relieved by the ordinary ethods of treatment (ice-bags over the heart; infusion of digitalis, tablespoonful every two hours, etc.).

CHAPTER IV.

DISEASES OF THE PERICARDIUM.

Pericarditis.

PATHOLOGICAL ANATOMY. *Pericarditis* may be described, according to its extent, as either a circumscribed or a diffuse inflammation of the pericardium. The *circumscribed form* of the disease affects the basal portion of the heart and its large vessels, while the *diffuse form* extends over the epicardial surface and the opposite wall of the pericardium. Since there is no difference in the character of the inflammatory processes, one common description will suffice for both forms of the disease.

The first appearances of change consist in an increased turgidity of the capillary vessels. The pericardial surface appears reddened and hyperæmic. Minute extravasations of blood may be observed at different points. The polished surface of the pericardial lining becomes tarnished and roughened, and it is soon overlaid with a thin layer of exudation. This gradually becomes thicker and partially organized, constituting a yellow or gray investment that covers the entire surface of the pericardium, and on inspection reminds one of the honey-comb appearance of tripe from the second stomach of the calf, or of the roughened surfaces that are produced by the sudden separation of two thickly buttered slices of bread. In advanced cases of the disease the movements of the heart within the pericardium produce a stringy or roughened appearance in the partly organized membranes that have been subjected to friction against each other. In this way are produced the so-called *hairy hearts* described by ancient authors, constituting what is now called *pericarditis fibrinosa*.

Besides its solid constituents the inflammatory exudation usually contains a considerable amount of liquid which may be either of a *sero-purulent* or *hemorrhagic* character. The most common form is the *sero-fibrinous* variety, which constitutes not less than two-thirds of the cases. In this form of the disease the liquid portion of the exudation is composed of transparent serum that contains a few clouded cells and fibrinous filaments.

Purulent pericarditis is characterized by an exudation of a purulent character, which often distends the pericardium to a capacity of three or four quarts, producing serious encroachment upon neighboring organs.

Hemorrhagic pericarditis usually occurs in connection with diseases marked by grave dyscrasia, such as cancer, tuberculosis, scurvy, and the hemorrhagic varieties of the eruptive diseases.

The results and consequences of pericarditis may be very numerous. The subpericardial structure of the heart may undergo fatty degenera-

, while the deeper layers of the muscular tissue of the organ may exhibit signs of inflammatory infiltration with small round cells.

Purulent pericarditis is sometimes accompanied by the development an ulcerative process in the pericardial tissue which may occasionally ade the superficial layers of the heart. The purulent contents of the rt sac sometimes find their way through the adjacent tissues into ghboring cavities within the thorax, or they may reach the surface ough the establishment of a pericardial fistula.

The inflammatory process sometimes extends to the external surface the pericardium, constituting *pericarditis externa*. In this way the diastinal connective tissue and the pleural surfaces may become olved.

When purulent pericarditis has been occasioned by the extension of ancerous growth from the walls of the stomach or from the œsophagus, when a purulent cavity within the lungs has effected a communica- n with the heart sac, the contents of the pericardium may undergo composition, constituting a *putrid pericarditis*. This always indi- es the introduction of air within the pericardium, and the consequent asion of its contents by the microörganisms of putrefaction.

In many cases the walls of the pericardium remain permanently ickened. Sometimes the products of fibrinous exudation become ganized into polypous masses which cover the whole surface with ft-like processes. Occasionally one of these becomes detached, and ay be found lying free within the cavity of the pericardium.

It very often happens during the course of pericarditis that the posite surfaces of the heart sac become adherent through the forma- n of organized bands of connective tissue. In the course of time ese may be ruptured by the movements of the heart, leaving visible aces of their presence upon the opposite surfaces. Sometimes, how- er, complete and permanent adhesion takes place. Sometimes the uid portion of the exudation is not absorbed, and the pericardial cavity permanently occupied by a spongy network whose meshes are filled ith a serous or purulent liquid. After a time the fluid portion of the is may be absorbed, leaving a residuum that can become infected with bercle bacilli, and be converted into a cheesy mass, constituting *tuber- dous pericarditis*. In certain cases this caseous deposit may undergo lcification, so that the heart may be actually surrounded by a cal- reous investment.

Symptoms. The impossibility of recognizing *pericarditis* through investigation of subjective symptoms renders it of importance that, all cases of articular rheumatism and other predisposing diseases, e heart should be frequently examined. The indications of pericar- tis may be divided into three groups: 1. Special symptoms. 2. ysical signs. 3. General symptoms.

1. *Special symptoms.* There are three special signs of pericarditis, mely: *pericardial friction sounds; extension of pericardial dulness percussion;* and *disappearance of the apex beat of the heart.* Fric- n sounds are obviously dependent upon fibrinous exudation. In- ased dulness on percussion and suppression of the apex beat depend on the fact of exudation without regard to its quality. The extent of

the territory within which friction sounds are audible gives no certain indication of the extent of the inflammatory process. In like manner the existence of friction sound is not a positive indication of pericarditis, since it may be produced in certain very rare cases of tubercular and cancerous disease, or calcification of the coronary arteries, or great enlargement of the heart, and excessive dryness of the pericardial surface itself may originate a friction sound; but in the vast majority of cases such sounds have no other cause than fibrinous exudation within the heart sac. The *quality of the sound* is always exceedingly variable. It may be very soft, or it may be very loud, with a creaking like that produced by the bending of new leather. It may acquire a metallic quality, if the stomach or any other neighboring cavity be distended with air. It sometimes is intermittent, and it may exhibit an increase of intensity in correspondence with the contraction of the auricles and the contraction and dilatation of the ventricles. In certain cases it resembles the fine, crepitant râles that are produced in pulmonary inflammation. Variations of pressure upon the thoracic wall, *e. g.*, with the tube of the stethoscope, may produce corresponding variations in the strength of the sounds, since it is evident that the effects of friction must vary as the opposite surfaces of the inflamed pericardium are brought nearer together. In this way, by the exertion of too great force, it is possible to suppress the sounds altogether. Variations in the position of the body, and the movements of respiration, exercise a similar influence.

The *duration of friction sounds* depends upon the length of time during which the pericardial surfaces are in contact with one another. It often happens that the sound which was audible at the commencement of the disease soon becomes suppressed by the occurrence of exudation, and is renewed only after the absorption of the liquid products of inflammation.

FIG. 119.



Percussion dulness in pericardial effusion; the lower and left margins left undefined, owing to their having been inseparable from the dull percussion of the abdomen and of the left pleura. (GAIRDNER).

The *extent of pericardial dulness* depends upon the amount of exudation. (Fig. 119.) The form of the distended heart sac, as determined by percussion, will depend somewhat upon the extent to

the lungs and the mediastinal connective tissues can be pushed
. In cases of extensive exudation, dulness may be discovered as
as the first costal cartilage upon the left side, and as far outward
e left axillary line; while upon the right side it may reach as
the mammary line, and downward as low as the eighth rib upon
ft side. In such cases the heart may be felt in the epigastrium,
the left hypochondriac region. The triangular shape of the region
ally occupied by cardiac dulness becomes thus transformed into
regular trapezoidal figure, with its longest side directed downward.
om what precedes, it is evident that the apparent force of the
beat of the heart must necessarily diminish with the progress of
ation which presses the heart away from the thoracic wall. Such
e of the apex beat may be distinguished from a similar condition
her cardiac diseases by the fact that the pulse remains full and
g in uncomplicated pericarditis, while it becomes weak and faint
her cardiac diseases.

Physical signs. *Inspection* indicates unusual prominence of the
ordial region; the intercostal surfaces are enlarged; the left
e consequently stands above the level of the right; the skin ap-
smooth and glossy; the subcutaneous veins become more conspic-
than usual. Such changes are more easily developed in children
in women than in men, whose thoracic walls are less yielding.
movements of respiration are greatly reduced upon the left side of
horax. The movements of the heart produce no distinctly visible
lse. The large veins of the neck are distended, and sometimes
it pulsatory movements.

e position of the patient is worthy of note. He must either lie
his shoulders elevated, or upon his left side; a position upon the
or upon the right side occasions great difficulty of respiration,
gh compression of the right lung, with which respiration is chiefly
rmed.

lpation indicates a greater tension in the skin upon the left side
e thorax than upon the right side. The subcutaneous areolar tis-
is sometimes œdematous through the production of collateral
na, dependent upon the pericardial inflammation. Vocal fremitus
olished over the region of dulness, and fluctuation has been ob-
d in cases marked by a wide separation between the costal carti-
and ribs.

rcussion indicates great extension of dulness around the heart.
ses of extensive exudation it may be difficult to distinguish be-
the pericardial border and the adjacent portion of the compressed
; but from *pleurisy with exudation* this dulness may be distin-
ed by an increase of vocal fremitus, which, on the contrary, is
ened in pleurisy. From *pneumonia* the condition of simple com-
ion of the lung may be distinguished by the absence of crepitant
, though dulness and bronchial breathing are common to both con-
ns. A tympanitic percussion sound ordinarily characterizes the
of compression to which that portion of the lung is subjected that
contact with the distended pericardium.

uscultation indicates an apparent diminution of the heart sounds,

which is dependent upon the intrusion of liquid between the heart and the thoracic wall. Systolic murmurs are frequently audible, and have their origin either in fever, degeneration of the muscular fibres of the heart, compression of the large arteries, or endocardial inflammation.

3. *The general symptoms* of pericarditis possess less importance than the above-mentioned signs. Subjective symptoms are of very little significance. Pain is sometimes felt in the præcordial region, especially when there is but little fluid exudation. It sometimes extends into the back, left arm, or the abdomen, and it is sometimes increased by pressure over the region of the heart and along the left border of the epigastrium. Palpitation of the heart, difficulty and rapidity of respiration, frequently occur as a consequence of hindrance to the pulmonary circulation.

Fever and elevation of temperature occur in the majority of cases, but may be entirely absent, even in purulent pericarditis. The pulse is usually frequent and strong, though often irregular. In the later course of the disease its vigor may be diminished as the muscular structure of the heart becomes injured. The urine is generally scanty and high colored, with acid reaction, and deposits a sediment of urates when cooled. Albuminuria is frequently present. If the circulation of blood be considerably impeded, œdema and general dropsy may occur. Death sometimes happens as a consequence of sudden heart failure produced by dropsical conditions of the brain. In other cases, cerebral hyperæmia may exist, and death may be preceded by delirium or convulsions and coma.

It occasionally happens that difficult swallowing, hoarseness, hiccough, and vomiting may be produced by pressure upon the œsophagus or upon the pneumogastric or phrenic nerves.

The *duration of pericarditis* is exceedingly variable. Occurring in scorbutic subjects, it may destroy life within twenty-four hours. When the amount of fluid exudation is small it may be healed in a few days. If it continues longer than four weeks, it may be called a chronic inflammation. Recovery is indicated by the gradual subsidence of the symptoms and physical signs of the disease, but it occasionally happens that through the contraction of adhesions the pericardial region becomes abnormally depressed and retracted. The cardiac nerves remain for a long time excessively irritable, so that the movements of the heart are easily excited by trifling causes.

ETIOLOGY. *Pericarditis* may result from *traumatic causes* which produce injury of the thorax; and it is often associated with *articular rheumatism*, usually following inflammation of the joints, though sometimes preceding that process. It is also a not infrequent complication of the *infective diseases*. *Cachectic conditions*, such as are produced by renal disease, cancer, pulmonary consumption, alcoholism, scurvy, and purpura hæmorrhagica, favor its occurrence. It may be produced by an *extension of the inflammatory process* from neighboring organs to the pericardium. *Abscesses in the lungs* and other adjacent organs or tissues may rupture into the pericardium, and thus produce inflammation of its structure. Other diseases of the pericardium, *e. g.* tuberculosis or cancer, may excite pericardial inflammation.

The *actual process of inflammation* is probably excited by the presence and activity of microörganisms which have invaded its structure. Streptococcus pyogenes and staphylococcus pyogenes aureus have been frequently found in the tissues, and the pneumococcus has been discovered in the exudations of pericarditis.

The disease occurs most commonly between the fifteenth and thirtieth years of life, and attacks males more frequently than females.

DIAGNOSIS. The recognition of *pericarditis* is very easy when the three principal symptoms previously enumerated are present. It must be remembered, however, that friction sounds may be mistaken for endocardial murmurs, especially when the first are faint and the last are unusually loud. Pericardial sounds are increased by moderate pressure, while endocardial sounds remain unchanged. A degree of pressure that interferes with the movements of the heart will suffice to weaken both sounds. Deep inspiration almost always diminishes an endocardial murmur but increases a pericardial friction sound. Sounds that are induced by the assumption of an erect position, or by leaning forward, are generally of pericardial origin. Endocardial murmurs are also closely connected with the movements of the heart, and are either systolic, diastolic, or præsystolic, while pericardial sounds do not always exhibit such accurate coincidence.

Friction sounds sometimes have their origin upon the pleural or peritoneal surfaces in the neighborhood of the heart, and they sometimes are connected with the movements of that organ as well as with the respiratory movements. They are increased by deep inspiration and expiration, by which their pleuritic character becomes evident.

Previous adhesions that have been caused by a former attack of pericarditis may hinder the development of friction sounds, but they can sometimes be excited by changes of position or by pressure over the pericardium.

The existence of *adhesions between the anterior surface of the heart and the pericardial wall* may prevent the occurrence of the characteristic dulness that is caused by pericardial effusion. The liquid exudation then occupies the posterior portion of the heart sac, and cannot be discovered by percussion. A similar difficulty arises when an emphysematous condition of the lung interferes with the lateral extension of pericardial dulness.

A coincident *encysted pleurisy* or an *inflammation of adjacent portions of the lung* may interfere with the accurate estimation of a pericardial effusion; but the presence of increased vocal fremitus, bronchial breathing and sonorous râles will assist in a definition of the extent of the pulmonary disease. *Aneurismal* and *mediastinal tumors* may be distinguished from pericardial enlargement by their different history as well as by their characteristic symptoms. Great *enlargement of the heart* may be distinguished from pericarditis by the fact that dulness on percussion remains unchanged in the upright position in the first disease, while in the last it extends farther upward when the patient stands erect. In pericarditis also the apex beat is weak or imperceptible, and does not coincide with the limit of dulness, though the

pulse remains full and strong. The heart sounds also seem diminished when there is considerable effusion into the heart sac.

The *character of the exudation* in pericarditis cannot be determined by the physical signs; it must be inferred from the antecedents and complications of the case. Occurring in connection with acute rheumatism, the exudation is usually of a *sero-fibrinous character*. Pyæmia and septicæmia give rise to *purulent pericarditis*. In cases of scurvy, cancer, tuberculosis and the hemorrhagic diathesis, the pericardial contents may be of a *bloody character*. The existence of *hydro-pericardium* may be inferred from the existence of obstruction to the circulation of blood, and from other causes of dropsy. Exploratory aspiration will reveal the character of the fluid.

PROGNOSIS. The prognosis in rheumatic pericarditis is favorable, but other forms of the disease are attended with great danger. Infancy, old age, and conditions of constitutional enfeeblement influence the prognosis very unfavorably. The disease is more dangerous among women than among men. The chronic form of the disease is more to be feared than the acute variety on account of its deleterious influence upon the nutrition of the muscular structure of the heart.

TREATMENT. The treatment of the acute, uncomplicated form of the disease consists in the adoption of dietetic and locally antiphlogistic measures. The patient should be placed in a large and well-ventilated apartment where the temperature can be maintained at 70° F.; and the air, when artificial heat is employed, should be kept moist by the evaporation of water. The patient must preserve the recumbent position, in order to avoid the danger of fatal syncope on rising up in bed. For this reason a bedpan must also be provided for the use of the patient, and constipation must be avoided by the use of compound rhubarb pills or large injections of water, if needed.

During the first fortnight the diet must consist of milk, eggs, broths, and gruel. Lemonade and other acid drinks may be allowed. Stewed fruit is useful to prevent constipation. Coffee and tea must be prohibited, on account of their tendency to excite palpitation of the heart, but the cautious use of wine and beer may be permitted, and should be positively recommended in chronic cases attended by debility and deficient nutrition. As the case progresses, a more substantial diet should be ordered—*e. g.*, the white meat of poultry, game, scraped beef, thin slices of ham, tender veal cutlets, sweetbreads, and calves' brains.

Local antiphlogistic treatment requires little more than the continued application of an ice-bag over the præcordial region. This moderates the action of the heart, and prevents palpitation. If the cardiac movements are not sufficiently diminished by local treatment, digitalis may be prescribed.

℞.—Potass. nitrat. ʒss.
Infus. fol. digital. fʒijss.
Syr. simpl. ʒss.—M.
S.—A tablespoonful every two hours.

A tendency to constipation may be obviated by the substitution of the bitartrate of potassium for the nitrate of potassium. If digitalis

ıot be tolerated, or if its toxic effects are developed, it must be dis-
inued, and it may be replaced by one of its substitutes. For this
on the patient should be frequently examined during its adminis-
ion.

he appearance of cardiac weakness will indicate the employment of
ulants. Wine or spirits may be given in small and frequent doses
required. If that prove insufficient, it may become necessary to
inister five or ten drops of ether on sugar every fifteen minutes, or
ain of camphor may be given every hour; or the drug may be used
odermically.

℞.—Camphor. gum. gr. xv.
Ol. amygdal. ℥ij.—M.
S.—℥ss when needed.

f the disease is attended with severe pain in the præcordial region,
t relief may be obtained from the application of several leeches over
seat of suffering. The skin should be thoroughly washed, and
tened with a little sweetened milk, and should be punctured with
point of a lancet wherever a leech is to be applied. Their number
the amount of bleeding that is to be permitted should depend upon
vigor of the patient. When the leeches have ceased to draw blood,
additional flow may be favored by the application of salicylated
on that has been dipped in warm water. Excessive bleeding may
ontrolled by the application of styptics. If leeches cannot be pro-
d, good results may be secured by the application of cupping-
ses, or a cantharidal plaster about three inches wide and four inches
. When this has produced a blister, its serous contents may be
uated by snipping the skin with a clean pair of scissors, and the
ace may then be dressed with a five per cent. carbolized oil or salve.
evere vomiting, hiccough, and difficult deglutition, or the occurrence
reat sleeplessness and distress, require the hypodermic use of
phine and atropine.

℞.—Morph. sulph. gr. ¼.
Atrop. sulph. gr. $\frac{1}{150}$.
Aq. destill. ℥ss.—M.
S.—Inject every three or four hours.

he occurrence of fever may be treated by the administration of ten
ns of phenacetine, or five grains of acetanilide every two hours, until
subsidence of febrile symptoms. Antipyrine, quinine, and the sali-
tes should be avoided on account of their debilitating influence.

ardy removal of the exudation may demand the use of iodide of
ssium, which may be given in small doses in connection with digi-

℞.—Potass. iodid. ℈ijss.
Pulv. fol. digital. gr. viij.
Excipient. q. s. ut ft. pil. no. xxx.
S.—One or two pills three times a day.

he præcordial region may be painted with the tincture of iodine, or
be treated with repeated blisters. If these measures fail of suc-

cess, diuretics and laxatives must be employed. Diaphoretics are objectionable on account of their tendency to produce palpitation, dyspnœa, and collapse. The infusion of adonis vernalis, in doses of a tablespoonful every two hours, and the hypodermic administration of the sodio-benzoate of caffeine night and morning, are highly recommended.

When the exudation cannot be removed by such therapeutical measures, if alarming symptoms threaten the life of the patient, it may be necessary to perform paracentesis of the pericardium. This may be accomplished by simple puncture in the fifth intercostal space, about an inch from the left border of the sternum. The operation must be performed in accordance with the method employed in pleurisy. If the pericardial effusion is of a purulent character, it should be evacuated through a free incision at the point where the pericardium lies in immediate contact with the thoracic wall.

During convalescence from pericarditis the patient must be restrained from too early assumption of the erect position, for fear of dangerous syncope. All forms of excessive excitement must be avoided for a long time.

Pericardial Adhesion—Synechiæ Pericardii.

It not unfrequently happens that as a consequence of *sero-fibrinous pericarditis*, more or less complete *adhesions are established between the opposite pericardial surfaces*. These may sometimes disappear as a consequence of the movements of the heart, or they may persist through life. Sometimes, also, it happens that the external surface of the pericardium becomes adherent to the thoracic wall, or to the spinal column, and the adjacent organs. As a consequence of these adhesions the anterior wall of the chest may become retracted, the movements of the heart may be seriously hampered, and the passage of blood through the aorta and the innominate veins may be considerably obstructed. Under these conditions the *phenomena of retrograde pressure* may be developed in the course of the circulation, viz., palpitation of the heart, rapid, weak, and irregular pulse, œdema, scanty secretion of urine, slight albuminuria, enlargement of the liver, general dropsy, bronchial catarrh, hemorrhagic infarcts in the lungs, dyspnœa, and cyanosis. The *physical signs*, when they exist, are often very obscure. It is only possible to arrive at the diagnosis with certainty when the patient has been under observation from the commencement of the disease; or when there is considerable retraction of the præcordial region during cardiac systole, associated with collapse of the large veins in the neck during the diastolic movement of the heart, a symptom which is produced by the forward protrusion of the thoracic wall and the consequent extraordinary aspiration of blood into the right auricle during diastole.

Treatment of pericardial adhesions cannot be undertaken with any hope of cure. Special symptoms of cardiac failure, or of obstruction of the circulation, must be treated as they appear, in accordance with the rules that have been given on previous pages.

It sometimes happens that by reason of the extension of the inflammatory processes, the *connective tissue of the mediastinum* becomes involved, with the production of adhesions or callosities by which the

reat vessels of the heart may become adherent to the sternum or to e spinal column or œsophagus, constituting what has been described *Mediastino-pericarditis fibrosa s. callosa.* The existence of this ndition may sometimes be recognized by the occurrence of swelling in e veins of the neck, and by variations in the pulse during inspiration, nstituting what has been described as *pulsus paradoxus* (Fig. 120).

FIG. 120.



"Pulsus paradoxus." I, inspiration; E, expiration. (After KUSSMAUL.)

his is characterized by the diminution or total disappearance of the rterial impulse during deep inspiration. The coincident swelling of ne cervical veins is caused through compression of the innominate eins by the mediastinal adhesions which are brought into a condition f increased tension during the act of inspiration, thus interfering with he aspiration of blood into the right auricle and its passage through he aorta during the expansion of the chest.

Hydro-pneumopericardium.

Besides the ordinary liquid exudations, the *pericardium may sometimes contain air or gas.* This may find entrance through external wounds or injuries of the thorax, or as a consequence of the establishment of a communication between cavities in the lungs, or a pyopneumothorax, and the pericardium. Ulcerations of the stomach may also find their way to the pericardium and result in the admission of air within its cavity. It is probable in all cases of pneumopericardium without evident opening of the air sac, that such an opening has at some time existed, or has been overlooked. It is possible that the gases of putrefaction might accumulate within the pericardium after death, in certain cases In such instances the appearances of inflammation would be absent.

SYMPTOMS. The *physical signs* of air in the pericardium are characterized by prominence of the præcordial region, with absence of the cardiac impulse and vocal fremitus. There is tympanitic resonance on percussion, with the development of a metallic tone, that is most evident during auscultatory percussion; and the occurrence of a splashing sound or metallic tinkling when the body of the patient is suddenly moved or shaken. Changes in position occasion a corresponding change in the level of the liquid and the location of the imprisoned air. The sounds of the heart acquire a metallic tone through resonance in the distended air-chamber of the pericardium, and they sometimes are increased to a degree that renders them audible at a distance from the patient; but if the amount of liquid in the heart sac be very considerable, they are generally much reduced. It occasionally happens that

friction sounds may also become audible. Somewhat similar sounds are sometimes produced in pyopneumothorax, or in extensive pulmonary cavities near the heart, or when the stomach contains air; but under such circumstances the ordinary dulness on percussion is persistent in the cardiac area.

The *prognosis* and *treatment* of *pneumopericardium* are exceedingly disappointing. Traumatic cases require puncture of the heart sac, and the evacuation of its contents through a canula provided with a caoutchouc tube whose distal extremity is immersed in a basin of water, to prevent admission of air into the heart sac. The trocar should be introduced through the fifth intercostal space, about one inch from the left border of the sternum, where the pericardium lies in immediate contact with the thoracic wall.

Dropsy of the Pericardium.—Hydropericardium.

The pericardium always contains a small quantity of fluid (*liquor pericardii*). This does not generally exceed one or two drachms. If the amount be greater than three or four ounces, it is probably the result of disease. Like other dropsical transudations, it is transparent and of an amber-yellow or greenish color, occasionally tinged with blood to a slight extent. Associated with cancer or tuberculosis of the pericardium, or with hemorrhagic diseases, a bloody color may be very strongly developed; under icteric conditions the transudate is bright yellow, and contains bile pigment and biliary acids. In chronic cases the pericardium may be greatly distended and thinned, and the subpericardial substance of the heart may exhibit a pale, macerated, and degenerated condition. Other morbid changes of the structure of the heart are dependent upon the causes of dropsy.

Hydropericardium is almost always a secondary consequence of diseases that interfere with the general circulation of the blood, or that produce an impoverishment of that liquid; though it may occasionally result from obstruction of the coronary veins through the development of cancer, or tuberculosis, or tumors involving the pericardium, or by reason of ossification of the coronary arteries.

The presence of a dropsical transudate in the pericardium may be recognized by the same physical signs that have been enumerated in connection with pericarditis. The general symptoms are those which characterize obstruction of the circulation.

The *prognosis* is generally unfavorable. Complete disappearance of the transudate may occur, but it is liable to reappear like other dropsical accumulations. The treatment must conform to the general indications for the management of dropsical symptoms in other parts of the body.

Hæmopericardium. An *accumulation of blood in the pericardium* without previous inflammation is occasionally observed as a consequence of wounds or ruptures involving the heart and its bloodvessels, and communicating with the pericardial cavity.

Chylo-pericardium. In very rare instances *chyle* has also been found within the pericardium as a consequence of the formation of a channel of communication between a *chyle duct* and the *cavity of the heart sac.*

CHAPTER V.

DISEASES OF THE AORTA.

Acute Inflammation of the Aorta—Endaortitis Acuta.

It occasionally happens that the *internal surface of the aorta* participates in the processes that occur within the heart, as a consequence of *ulcerative or verrucose endocarditis.* The disease sometimes appears to have been preceded by chronic inflammation; and it is occasionally connected with alterations in the cusps of the aortic valve. It must not be confounded with the appearances that are produced by post-mortem discoloration of the arterial surface with the hæmoglobin of the blood. Its *exciting causes* are, for the most part, connected with those of the infective diseases, and with Bright's disease, gout, lead poisoning, alcoholism, and cancer. The *symptoms* of acute inflammation of the aorta are so closely connected with those of acute endocarditis that a positive diagnosis can scarcely be possible before death.

Chronic Inflammation of the Aorta—Endaortitis Chronica.

Pathological Anatomy. *Chronic inflammation of the inner coat of the aorta* causes a development of thickened and indurated patches in the intima of the vessel, which produce a roughened and elevated appearance of its inner surface. This is most conspicuous in the ascending portion and in the arch of the aorta, in those places where the blood stream impinges with greatest force upon the arterial wall.

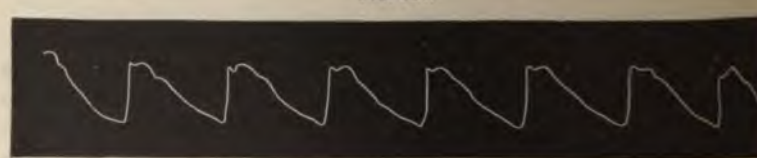
The thickened patches that have been thus formed sometimes undergo fatty degeneration, producing what is called *atheroma.* The endothelial surface finally gives way, and the atheromatous mass is washed out by the current of the blood. If the patch be very superficial, a simple abrasion of the surface is the result; and this may become the seat of a *thrombus.* But when the atheromatous degeneration has extended to a considerable depth, a deep *atheromatous ulcer* is formed, along the borders of which thrombi may become developed. Sometimes, instead of these changes, *calcification*, occasionally *ossification*, takes place. The extent of calcification may sometimes be so great that the entire circumference of the aorta seems to be transformed into an unyielding cylinder of mineral matter. Similar processes may invade the middle and external coats of the aorta and its branches. As a general rule the tendency of such degeneration is greatest at the

entrance of the vessel, and it diminishes as the distance from the aortic valve is increased.

ETIOLOGY. *Chronic inflammation of the aorta is a disease* of old age. It is especially common among laboring people and among the victims of syphilis, Bright's disease, obesity, gout, and diabetes. Excessive use of tobacco and alcohol, and poisoning with lead, all tend to favor the development of the disease. Since these causes operate more commonly upon the male sex, atheromatous vessels are more frequently discovered among men than among women.

SYMPTOMS. *Chronic inflammation of the aorta* may exist to a moderate extent without producing any recognizable symptoms. Among the earliest evidences of its existence may be mentioned the development of a *tympanitic character* in connection with the diastolic aortic sound. Obviously this will not be developed unless the aortic valve is free from disease. Sometimes the systolic sound of the heart is accompanied by a *murmur* which is conditioned by the abnormal vibrations in the aortic wall. Sometimes the *area of aortic dulness* may be slightly increased, and pressure with the fingers in the jugular fossa may discover evidences of *induration* in the enlarged and inordinately prominent arch of the vessel. Similar changes may sometimes be made out in the *abdominal aorta*. Occasionally the phenomena of *thrombosis* and *embolism* may be observed to follow the existence of such changes. It sometimes happens that the phenomena of *endocarditis* become connected with the symptoms that have been already detailed, indicating an intimate connection between aortic and endocardial diseases. The *cusps of the aortic valve* are most liable to become affected; sometimes the *curtains of the mitral valve* are also involved. In this way the symptoms of chronic endocarditis may be sometimes masked, during life, by those of valvular disease. The connection between *dilatation and hypertrophy* of the left ventricle and arterial disease is very evident from the fact that, through reduction of the contractile power of the aorta, greater effort is needed on the part of the ventricle to effect the propulsion of the blood through the arterial system.

FIG. 121.



Senile pulse. Patient aged seventy-two; arteries very rigid; considerable hypertrophy of the left ventricle. (FINLAYSON.)

The occurrence of *atheromatous degeneration* and *calcification* in the *peripheral arteries* affords considerable presumptive evidence of a similar condition in the aortic wall. The radial artery at the wrist, and the temporal artery afford conspicuous examples of these changes, through which they become serpentine and rigid, with consequent delay in the development of the pulse. The sphygmographic curve exhibits

ded development of the ascending limb, with a rounded form of pex and the absence of wave-marks in the descending branch of urve—unmistakable evidences of the loss of elasticity that char- izes the degenerated arterial coats. (Fig. 121.)

extensive *arterio-sclerosis* many of the diseases of old age find origin, either by reason of retarded circulation, or through the lopment of thrombi, or as a consequence of actual rupture of vessels. In this way the symptoms of cerebral anæmia and starva- , or actual hemorrhage, may arise. Chronic nephritis, cirrhosis e liver, and other kindred diseases, may be developed in the same ; and life is terminated after the appearance of the most various ptoms.

REATMENT. The insidious character of the disease prevents the ibility of early or specific treatment. Of principal importance is proper regulation of the diet and habits of life. Iodide of potas- , in five-grain doses, three times a day, has been recommended; as a general thing, the treatment must be symptomatic and cted to the diseases that predispose to the occurrence of endarteritis, o the consequences of its development.

Aneurism of the Aorta—Aneurysma Aortæ.

An *aneurism* is a circumscribed dilatation of an arterial duct. Ac- ding to their form, aneurisms may be classified as (a) *sacculated;* *cylindrical;* (c) *spindle-shaped.* Aneurisms may be so small that y are scarcely visible, as when they occur in the course of the cere- l vessels, or they may reach the dimensions of the skull.

Aneurisms are said to be *axial*, when the whole circumference of artery participates in the dilatation; they are said to be *peripheral* en they are formed by a simple lateral protrusion of the wall upon e side only of the artery.

The cavity of the aneurism generally contains thrombotic layers ich exhibit an imperfect effort at organization. The cavity is, some- es, gradually filled with a fibrinous network that contains colorless od-corpuscles, broken-down red corpuscles, and crystalline masses of od pigment. In this way the aneurismal sac may be obliterated, and ort of spontaneous recovery may be effected. These thrombotic posits occur in all forms of aneurism, but they are most developed in sacculated cases, especially when the orifice of the cavity is con- erably constricted.

Generally, the three coats of the artery participate in the formation an aneurism; very frequently, however, endarteritis and fatty generation precede the evolution of the disease, and accomplish their ults through an enfeebling influence upon the resistance of the erial wall. Atheromatous changes, however, need not always pre- e the growth of an aneurism, since they may occur as secondary or ociated incidents. It is probable that changes in the middle and ernal coats of the artery which are analogous to the changes that ur in myocarditis, may often precede the formation of an aneurism. *croscopical investigation* indicates the occurrence of atrophy and

disappearance of the elastic coat previous to the disappearance of t intima and of the external coat of the vessel. With the yielding of t external layer rupture must take place, unless the neighboring tiss by their adhesion serve to supply the place of the atrophied wall.

The danger that attends the development of an aneurism consi chiefly in the progressive enlargement of its sac by which neighbori structures are compressed so that their function may be impeded destroyed. The particular character of the disorder thus produced w depend upon the site of the aneurismal sac, and upon the direction its growth. In this way the *lungs* may become compressed and u less, and the *large nerve trunks* within the cavity of the thorax m be greatly disturbed. *Respiration* and *vocal articulation* may be th thrown into great disorder. The *bony walls of the thorax* may al experience the effects of pressure, resulting in atrophy and disappe ance of the upper part of the sternum and of portions of the ribs, or the spinal column. After the absorption and removal of these stru tures, the aneurismal tumor remains covered only by the superfi tissues and the cutaneous investment of the thorax. *Rupture* so follows, either as a consequence of muscular exertion, or through t development of ulceration at the point of greatest pressure. Aneurism rupture is not always, however, upon the surface of the body, but m take place at any point of least resistance, thus effecting a communic tion with, and a discharge of its contents into, any of the cavities vascular channels within the thorax. Similar complications are o served when the abdominal vessels are the seat of aneurismal dilatati As a consequence of absorption of the bodies of the vertebræ, an ane rism may rupture into the spinal canal, with consequences that depe upon compression or destruction of the spinal cord.

Aortic aneurisms involve the thoracic portion of the vessel in abo 75 per cent. of the cases; the *abdominal aorta* and its branches furni about 25 per cent.; within the thorax, nearly 60 per cent. of the ca originate in the *ascending portion of the aorta*, while nearly 30 p cent. are seated upon its *arch*.

Etiology. *Aneurisms* occur more frequently in the male sex th in the female, and develop during the period of greatest activity b tween the thirtieth and fiftieth years of life. Syphilis, gout, rheum tism, alcoholism, excessive exertion, and injuries are among the mo common causes of the disease. Exposure to cold and damp acts as predisposing cause for the development of the disease.

Symptoms. *Aneurisms of the aorta* may exist without symptom but when they have attained any considerable magnitude they occasi most serious consequences.

Exceedingly valuable as a diagnostic symptom is the existence of *pulsating tumor*. If the *ascending portion of the aorta* is the point its origin, the tumor will be discovered near the right border of t sternum, in the upper intercostal space. If seated upon the *arch of t aorta*, it will bulge upward into the jugular fossa, and press laterally either direction. *Aneurisms of the descending aorta* lie nearer t spinal column, and exert their pressure between the spine and the l shoulder-blade. *Aneurisms of the abdominal aorta* also make th

appearance upon the left side of the spinal column. When the tumor begins to bulge externally, the skin immediately over it becomes tense and shining. As pressure increases, the surface becomes reddened, and, finally, falls into a condition of necrosis. The necrotic spot is covered by a dry, brown scab, which, at last, separates and is followed by an oozing of blood which may increase until complete rupture takes place.

Another valuable symptom is furnished by the *pulsation of the tumor* which can be distinctly felt, and becomes visible as the mass protrudes through the thoracic or abdominal wall. So nearly does this resemble the cardiac pulsation that, as has been often remarked, it may seem as if two hearts were beating in the same breast.

On *palpation* the tumor presents a yielding and elastic mass; the characteristic pulsation is perceived as a regular rhythmical movement, with alternate contraction and dilatation in every direction, a circumstance that is sufficient to distinguish an aneurismal tumor from other growths that may chance to rest upon an arterial trunk. A systolic impulse of the heart can be felt, usually, with great distinctness in the aneurismal tumor, and it is frequently accompanied by a purring fremitus.

Percussion over the tumor gives evidence of dulness in correspondence with its extent. When the aneurism lies behind the upper portion of the sternum the normal resonance is lost, and is replaced by dulness on percussion. Similar dulness may reveal the existence of unsuspected aneurisms that have presented no other symptoms. Percussion of an aneurismal tumor in the abdomen may lead to some confusion, if the tympanitic resonance of the intestines be not sufficiently considered. It is well in doubtful cases to secure a thorough evacuation of the bowels, previous to examination.

Auscultation yields very different results in different cases. There may be distinct systolic sounds or murmurs, diastolic sounds or murmurs, or both; such murmurs are sometimes audible at a considerable distance from the patient. The causes of these variations lie in existing differences of form and size of the tumor, and in variations of the rapidity of the blood current as it passes through the aneurismal cavity. The existence of valvular diseases within the heart may also occasion the propagation of morbid sounds as far as the aneurismal tumor, when it lies within the thorax, where they may then seem to be originated. Through failure of conduction to an unlimited distance from the heart, abdominal aneurisms rarely afford any such second sound or murmur.

It is not unusual for *cardiac diseases* to be associated with the existence of an aneurismal tumor. *Aortic insufficiency* is frequently occasioned by the same chronic inflammatory process that originated the aneurismal development. *Mitral disease* is a less frequent event. *Hypertrophy and dilatation of the left ventricle* are not uncommon as a result of the inflammatory action, rather than as a consequence of the existence of an aortic aneurism. An uncomplicated aneurism of the aorta may actually become the cause of dilatation and atrophy of the left ventricle, through pressure upon the pulmonary artery, by which the right ventricle becomes enlarged; while, at the same time, the

left ventricle shrinks in consequence of diminished labor and imperfect nutrition, as the health of the patient fails.

Through the enlargement of a thoracic aneurism, the *position of the heart may be gradually displaced* downward and to the left, if the tumor be seated upon the ascending portion or upon the arch of the aorta; while it may be crowded toward the right, if the descending aorta be involved.

As the disease progresses the *movements of the heart may become irregular.* Palpitation and dyspnœa may occur, and may be accompanied by severe paroxysms of angina pectoris. Such disturbances are not uncommon in certain positions of the body, so that patients are compelled to remain in a sitting posture, or to lean forward, or to assume various abnormal positions. During periods of excitement the cardiac pulsations extend into the carotid arteries The *pulse* at the wrist, beyond the aneurismal tumor, generally lingers behind the cardiac impulse, so that an aneurism of the arch, lying between the innominate artery and the left carotid, occasions delay in the development of the arterial pulse upon the left side, while the pulse upon the right side remains synchronous with the cardiac beat. The *pulsus paradoxus* (p. 581) is sometimes developed as a consequence of reduction in the blood pressure, through the act of inspiration, within an aneurismal tumor that communicates with the artery in question. The *large veins in the neck* sometimes exhibit evidence of obstruction and negative pulsation, through compression of the venæ cavæ. Collateral paths for the return of the blood may become apparent through prominence of the cutaneous veins; and the subcutaneous tissues may become actually œdematous; while the abdominal viscera suffer the usual consequences of retarded blood circulation.

The *pulmonary organs* frequently experience great embarrassment through compression of the bronchi, or of the lung tissue itself. The left bronchus obviously suffers more frequently than the right. Retraction of the intercostal spaces during inspiration may occur through impossibility of adequately expanding the lung. Vocal fremitus is diminished or entirely absent. Percussion yields a tympanitic resonance which is transformed into complete dulness if the lung be wholly displaced by the aneurismal tumor. Auscultation indicates corresponding reduction and transformation of the respiratory sounds. *Asthmatic paroxysms* sometimes occur, which are dependent upon *compression* and *irritation of the pneumogastric nerve branches.* Sometimes spasm of the glottis, vomiting, or cardiac disturbance, may occur through irritation of the laryngeal, gastric, or cardiac branches of the nerve.

Laryngoscopic examination not unfrequently reveals a paralytic condition of one or both recurrent nerves. The voice becomes hoarse, or reduced to a whisper, and may alternate with a feebly spasmodic cough. Complaint is sometimes made of dragging sensations in the throat, as if the larynx were subjected to rhythmic traction in the direction of the sternum.

By reason of *pressure upon the œsophagus*, difficulty of deglutition is sometimes experienced; examination of the passage with an œsophageal sound should be performed with great caution, since aneurismal

mors have sometimes been ruptured in this way, with immediately tal consequences. Sometimes the difficulty that attends swallowing ries with changes in the position of the body.

One of the most distressing consequences of the development of an neurismal tumor is the occurrence of *neuralgia;* this is most frequently perienced in the left arm, by reason of the pressure to which the rachial plexus is subjected; a *paralytic condition* of the limb may be roduced by such pressure, as the tumor enlarges. *Intercostal neuralgia* is associated with aneurisms of the descending aorta; and, when ey are developed upon the abdominal aorta, severe pain in the back ccurs, and the patient becomes bent and bowed through suffering. If e spinal column is opened through the effect of pressure, the *lower xtremities and the bladder and rectum* become *paræsthetic* and more r less completely *paralyzed. Insomnia* often occurs as a most distressg consequence of the pain and discomfort that attend the development f aneurismal tumors. The *vasomotor nerves* sometimes exhibit evidences of irritation or of paralysis in the neck and about the head. The upils are also either dilated or contracted through a similar condition f their nervous supply. Some observers have endeavored to trace a onnection between *mental derangement* and the existence of carotid neurisms.

Abdominal aneurisms occasion equally serious disturbances of the bdominal viscera; when located near the diaphragm they may extend eir influence into the cavity of the thorax through upward enlargeent or pressure. Gastralgia, paroxysmal vomiting, attacks of colic, ifficulty of defecation, severe jaundice, hydronephrosis, and other evidences of compression may be observed according to the site and the imensions of the tumor.

In addition to the symptoms that may be directly referred to aneusmal growth and pressure, it is not uncommon to observe a *high egree of subjective misery;* there is complaint of all manner of pain in fferent parts of the body; sensations of beating and thumping are exrienced as if they were originated within the brain; sometimes such mptoms are increased in certain positions of the body. The occurce of such inexplicable suffering should lead to the suspicion of the stence of a latent aneurism.

The *duration of the disease* is exceedingly variable; the average od after the discovery of a tumor is from fifteen to eighteen ths.

ecovery seldom occurs. *Death* may occur through the develop t of a cachexia, such as is sometimes observed as a consequence of ular disease of the heart. Hemorrhages take place from the ous membranes, and death is preceded by œdema and marasmus. ther cases compression of the œsophagus may occasion slow starva ; again, death may result from axphyxia, occasioned by compres of the lungs or respiratory passages; intercurrent inflammations, alysis, or embolic process in the brain or peripheral arteries, may to a fatal termination.

Death very often results from the rupture of an aneurismal tumor. is may occur externally or into neighboring cavities within the body,

with the symptoms of internal hemorrhage and distention of the affected cavity, *e. g.*, pericardium or pleura. The establishment of an opening between the aneurismal cavity and the neighboring duct will be indicated by expectoration of blood from the bronchi or trachea, or by its eructation from the œsophagus. Vomiting or purging of blood, and its appearance in the urine, indicate a communication with the stomach or the intestines, or the urinary passages.

DIAGNOSIS. The diagnosis has for its objects the recognition of the existence of the aneurism, and also the determination of its locality. The occurrence of paralysis of the laryngeal muscles, or difficulty of deglutition, and severe neuralgic pain, especially if associated with circumscribed murmurs in the course of the aorta which cannot be otherwise explained, should lead to the suspicion of latent aneurisms.

If a pulsating tumor be discovered, it must be differentiated from *solid tumors which rest upon the aorta* by reference to the character of the pulsation, which is uniformly developed in every direction in the case of aneurismal enlargement, while a solid tumor simply rises and falls in a direction at right angles with the course of the artery upon which it lies.

Having determined the existence of an aneurism, its location may be inferred by its prominence near the right border of the sternum in the second and third intercostal spaces, when it is connected with the *ascending aorta*. If originating in the *innominate artery*, it projects upward and outward under the right clavicle. *Aneurisms of the arch of the aorta* occupy the space behind the upper portion of the sternum or along its left border; *aneurisms of the descending aorta* are most commonly observed in the back, at the level of the eighth thoracic vertebra; while *aneurisms of the abdominal aorta* can be easily located if the abdominal walls are sufficiently yielding and unincumbered with fat.

PROGNOSIS. Aortic aneurisms afford a very unfavorable prognosis. Spontaneous recovery rarely occurs, and the effects of treatment are not encouraging.

TREATMENT. The ordinary rules that have been previously laid down for the treatment of severe cardiac diseases must be observed. Pain is most surely relieved by the hypodermic use of morphine; palpitation and cardiac debility may be temporarily relieved with ice and with digitalis; impoverishment of the blood requires the administration of iron, quinine, and ferrated mineral waters. The external development of the tumor may call for applications of collodion, and for supporting apparatus in the form of well-adjusted bandages.

Iodide of potassium (five to ten grains, three times a day) is recommended, especially in cases that are dependent upon syphilitic infection. Astringents have also been extensively employed; and the daily hypodermic injection of ergotine has its advocates.

Efforts for the direct coagulation of the blood within an aneurismal cavity have been frequently attempted; for this purpose the liquor ferri perchloridi has been injected into the cavity of an aneurism, but this is a very dangerous experiment in consequence of the risk of producing embolic obstruction of peripheral arteries with fragments of the

that are thus formed. Other experimenters have attempted the duction of fine wire, slender watch springs, floss silk, and other ar substances, with a view to the coagulation of the blood as it is ght into contact with these foreign bodies. Less hazardous, per-, is the employment of the constant current by the introduction of ng, slender needle into the cavity of the tumor, which is thus ght into connection with the anode of a battery containing eight elements, while the cathode is in communication with an indiffer- portion of the body outside of the tumor; the needle must be lated throughout the greater portion of its length, so as to avoid a tic effect upon the thoracic wall; the current should not be passed ugh the tumor for more than an hour. Coagulation takes place nd the uninsulated portion of the needle; and upon the clot thus ed, additional precipitation of fibrin may occur. The operation be repeated after a few days, if necessary.

he treatment of subclavian and other aneurisms by ligature de- ds surgical interference, regarding which full particulars are con- ed in the text-books on surgery.

Constriction and Occlusion of the Isthmus of the Aorta.

hat portion of the aorta between the region of the left subclavian ry and the commencement of the descending aorta constitutes the mus. During fœtal life this portion of the vessel is abnormally tricted, and it occasionally happens that such constriction persists birth. Sometimes the *calibre of the aorta* becomes so reduced it will admit the passage of nothing larger than a bristle; again, ay be completely occluded. The *left ventricle of the heart* is fre- ntly dilated and hypertrophied, and the endocardium may exhibit sequences of chronic inflammation. The *ascending portion of the h of the aorta* becomes dilated as a consequence of the obstruction, it may exhibit evidences of *endarteritis*. The blood is compelled ind collateral channels for its circulation, and, consequently, all the nches of the left subclavian artery become enlarged. The branches the internal mammary, transversa colli, and transversa scapulæ eries, through their communications with the intercostal arteries, nish a passage for the blood into the descending aorta within the rax; while the lower branches of the mammary artery afford a com- nication by way of the superior and inferior epigastric arteries with iliac vessels. The enlarged vessels become serpentine, and pulsate tinctly. The degree of constriction in the isthmus of the aorta may, h considerable accuracy, be inferred from the amount of development hibited by the collateral circulation.

The *pulsations* in the *abdominal aorta*, and in the *crural artery*, are siderably retarded in comparison with the cardiac impulse, and the rent of blood through those vessels is usually much diminished. e *left ventricle becomes dilated and hypertrophied* in about one-half the cases.

It often happens that the defect is only discovered after death. In ier cases the usual *consequences of cardiac overwork* are manifested

—*e. g.*, palpitation, subjective dyspnœa, cough, hæmoptysis, dropsy, and the other consequences of obstructed circulation. *Death* sometimes is caused by cerebral hemorrhage, or by rupture of the heart, or as a consequence of cardiac paralysis after violent muscular exertion. Intercurrent diseases may also terminate life, which is sometimes greatly prolonged in spite of the defect, in one case reaching to the ninety-second year.

Congenital Narrowness of the Entire Aorta.

By reason of defective nutrition during fœtal and early life, it sometimes happens that the aorta never reaches its normal development, but always retains infantile dimensions. Under such circumstances its walls are excessively thin and yielding. The changes that are produced by chronic inflammation are not uncommon in its coats. The defect is usually observed among chlorotic patients, and is associated often with defective development of the sexual organs. Dilatation and hypertrophy of the heart, with the usual consequences, are not uncommon.

Rupture of the Aorta.

The aorta may be penetrated by wounds and injuries, but its spontaneous rupture is dependent upon previous disease affecting its walls—*e. g.*, endarteritis, and fatty degeneration. It often occurs as a consequence of aneurismal dilatation; again, it may be observed as a consequence of ulcerative processes in the neighborhood of the vessel, such as occur in caries of the vertebræ, cancer of the œsophagus, or ulceration of that passage subsequently to its injury by swallowing foreign bodies that become lodged in its course, or produce laceration of its walls.

Complete rupture of the arterial wall produces speedy death from hemorrhage; but, sometimes, the rent does not extend through the whole thickness of the aortic wall, but may involve only the inner coat; the blood then finds its way between the outer coats and the middle and internal layer, producing what is called a *dissecting aneurism of the aorta*. In this way blood may find its way between the layers of the arterial wall as far as the peripheral arteries. A dissecting aneurism has been known to extend from the entrance of the aorta as low as the popliteal artery. Complete rupture usually follows after a time, though cases of recovery have been known.

The occurrence of aortic rupture is sometimes indicated by sudden, severe pain, as if something had given way within the body; this is followed by great anxiety, rapid anæmia, and speedy loss of strength—symptoms which indicate internal hemorrhage. Death may occur almost instantaneously, or only after several days. Longer duration of the condition is very rare.

Embolism of the Aorta—Embolia Aortæ.

Aortic embolisms are very rare. They sometimes occur as a consequence of endocardial thrombi which break loose and obstruct the

they may be produced by tumors, or by echinococci, which nd entrance into the left ventricle. Aneurismal clots some- er the circulation, and obstruct its course through the descend- ı. Similar results have been known to follow childbirth, or diseases.

'OMS. The symptoms depend upon the level of the obstruction. *death* follows occlusion of the upper portion of the aorta. quently the obstruction takes place at, or near, the bifurcation dominal aorta; this produces *obstruction of the circulation in th of the iliac vessels;* its occurrence is frequently indicated ıation of severe pain in the lower part of the abdomen or in the es; the lower limbs become cold, stiff, and enfeebled; various of sensation are experienced in the affected parts; the skin and is either pale or livid; the arterial pulse cannot be felt he seat of obstruction; sensibility and the power of motion in ed limbs is greatly reduced or entirely abolished. If a collat- ılation can be established, the symptoms gradually subside; ɛtimes, they are renewed or transferred to other portions of the t often happens that the embolism in one of the arteries of the nbs may become the starting-point of a thrombus which may pward even as far as the iliac trunk. *Complete obstruction of ılation* is followed by dark discoloration of the skin, with the ıent of dry and moist gangrene in the extremities. *Death* a consequence of exhaustion or of septicæmia. Embolism of .cic or abdominal portion of the aorta is attended by the above- l symptoms, and also by evidences of spinal anæmia, among ralysis of the bladder and rectum are conspicuous. Occlusion astro-intestinal and renal arteries may be followed by vomiting ging of blood, and by the presence of blood in the urine.

ıOSIS AND TREATMENT. The prognosis is very unfavorable. tment must be purely symptomatic.

Thrombosis of the Aorta—Thrombosis Aortæ.

ɔnsequence of arterio-sclerosis small and insignificant thrombi unfrequently observed upon the inner lining of the aorta. almost universally observed in cases of aortic aneurisms, and etimes extend from the cavities of the heart into the aorta. mbolism sometimes produces extensive thrombosis, and the ng may be produced by compression of the arterial wall. uch circumstances they are more commonly observed in the ıl aorta than in the thoracic, because of the greater force of lation in the upper portion of the vessel. The symptoms vary ɜ to the magnitude and the location of the thrombus. Con- obstruction of the aorta may lead to the development of s which indicate obstruction of the circulation; and complete of the upper part of the vessel is followed by speedy death.



PART VII.

DISEASES OF THE BLOOD.

CHAPTER I.

DISEASES OF THE BLOOD.

Leukæmia.

TIOLOGY. *Leukæmia* is a disease that is characterized by a pro-ive increase in the number of white blood-corpuscles, while the ber of red corpuscles is steadily diminished.

ree forms of leukæmia are usually described: the *splenic* variety, hich the origin of the disease is supposed to be located in the n; the *lymphatic*, and the *myelogenous* varieties, in which the h glands and the marrow of the bones are respectively implicated. matter of fact, however, these forms of the disease are usually iated. Sometimes one set of organs, sometimes another, is ly affected. The *splenic form* is most commonly observed; and this is frequently associated the *lymphatic variety*. It is probable the osseous marrow is involved more frequently than has been d, since its examination is attended with greater difficulty than the stigation of the other organs of the body.

eukæmia is observed about twice as often among men as among en. It usually occurs between the twentieth and fiftieth years of though it has been described among children and among old people. among the poorer classes of society that it most frequently exists, it seems to be more prevalent in certain countries and localities in others. *Hunger*, *cold*, and *squalor* appear to favor its develop-t. It has sometimes followed *injuries of the spleen* or of *the bones*. *lent exertion* and *mental stress* favor the development of the ase. Among the female sex, the incidents of *pregnancy*, *parturi-*, etc., are not without unfavorable influence. It has been noted as esult of *chronic diarrhœa*, and of cachetic conditions following ious *infective diseases*, especially after malarial poisoning. *Rickets* y be mentioned as a predisposing cause, and sometimes *pseudo-kæmia* becomes merged in the full-fledged disease.

SYMPTOMS. The cardinal symptom of *leukæmia* is the change in *nber of the corpuscular elements of the blood*. The microscope dily reveals the presence of an *excessive number of white blood-*

corpuscles. Instead of one colorless corpuscle to every 350 or 500 red corpuscles, their respective numbers are sometimes equal; and occasionally the white corpuscles are in a majority. (Fig. 122). Under such circumstances the blood appears thin and pale, occasionally so greatly altered in its constitution that it looks more like dirty water than like healthy blood. Not only is the number of the white corpuscles greatly increased, but that of the red corpuscles is also largely diminished. Instead of containing 5,000,000 of corpuscles, the cubic millimetre

FIG. 122.



Drop of blood from a case of splenic and lymphatic leukæmia. There is great excess of the white corpuscles; these are seen to be of various sizes. (Drawn from an actual "field" by DR. JOHN WILSON.

may contain less than one-tenth of that number, in severe cases of the disease. The red corpuscles are variable in their size, and frequently present irregular deformities, constituting what is known as *poikilocytosis.*

The *specific gravity* of the blood is considerably diminished, and its *coagulability* is reduced. When drawn from the veins it clots loosely, with a layer of white corpuscles forming a pallid surface upon the external portions of the coagulum. The amount of hæmoglobin in the blood is necessarily diminished by the reduction in the number of the red corpuscles. It is sometimes, though not always, diminished below the normal standard in the individual corpuscles themselves.

The *spleen* is almost always greatly enlarged. It is sometimes sensi-

ressure, and its capsule may be roughened by peritoneal ion, so that a friction sound is audible when the abdominal he tumor undergo relative displacement by pressure or other- ipture of the spleen has been known to occur as a consequence mous distention.

aph glands are often greatly enlarged, and become prominent skin, especially in the neck, in the axillæ and groins These glands are not sensitive to pressure, and they are not adherent ther or to the skin. Unlike the enlarged glands in tuber- ey rarely exhibit any evidence of inflammation, caseation, or n. In many instances the spleen and lymph glands undergo nt a considerable time before the manifestation of pathologi- s in the blood. The lymphatic glands within the thorax and inal cavity also manifest a similar tendency to increase in npression of the trachea and bronchi may thus be originated, considerably with the act of respiration. Compression of the stric nerve may disturb the action of the heart, and may pro- lysis of the laryngeal muscles. Within the abdominal cavity ed mesenteric glands may be recognized in the form of mul- rs. The adenoid tissue in the tonsils, and about the root of e, and in the pharynx, sometimes becomes swollen. The d thyroid glands may participate in the general process of disease.

he *marrow of the bones* becomes involved it is sometimes indi- ain, especially in the sternum and spinal column. Sometimes ones also exhibit a similar condition.

ount of *uric acid* in the urine is considerably increased, some- hing an amount that is six or seven times greater than the antity. The *phosphates and sulphates* are also increased, *ea* does not exhibit any decided change until the progress of letermines its reduction.

ut one-fourth of the cases of leukæmia the *retina* exhibits stic changes. It is usually pale and yellow; the veins are nd tortuous, and of a lighter color than in the healthy eye; s are contracted; sometimes hemorrhages into the retina are nd yellow spots, surrounded by extravasated blood, become ; when the lesions approach the macula lutea, eyesight is affected, and thus attention may be directed to the disease.

se of hearing is sometimes affected by the development of tissue in the labyrinth. Hemorrhages in the cochlea some- luce sudden deafness.

nally lymphoid indurations exist in the skin.

the *earliest symptoms* of the disease are increasing pallor ished vigor. Sometimes *pain* is experienced in the region of . The subcutaneous layer of fat is often retained until a late the disease. Copious *perspiration* is not uncommon, especi- e form of night-sweats. *An œdematous condition of the skin* served, and a tendency to boils and pustulous eruptions is mon. The *temperature* is sometimes elevated, but presents m or regular increase. The *pulse* is generally weak and

rapid. As a consequence of the diminution of the number of red blood-corpuscles there is frequent complaint of breathlessness. Sometimes actual *dyspnœa* is produced through compression of the respiratory passages by enlarged lymph glands. *Catarrhal inflammations of the respiratory organs* are not uncommon, and sometimes result fatally. The *heart* is frequently dilated, and may be displaced by an enlarged spleen. *Anæmic murmurs* are also audible.

The cavity of the *mouth and pharynx* are not frequently inflamed. The *appetite* disappears, but *thirst* is increased. Sometimes *fatal hemorrhage* from the fauces or other portions of the oral cavity may occur. The usual symptoms of *indigestion* are furnished by the stomach and intestinal canal. Sometimes obstinate *diarrhœa* terminates the life of the patient. The *liver* is usually enlarged, and sometimes *ascites* is developed.

A tendency to uncontrollable *hemorrhage* is a characteristic symptom of leukæmia. It may occur from any portion of the mucous membrane of the body, or into any of the organs and tissues.

The *intellectual faculties* remain undisturbed until the close of life, but the delirium and mental derangement that accompany exhaustion are not uncommon events.

Leukæmia is a disease that usually persists for one or two years, though cases are described in which it has continued for eight years. Occasionally, however, an acute form of the disease may develop and complete its course to a fatal result in the space of three or four weeks. These cases are sometimes accompanied by a febrile movement that subsides into a typhoid condition. *Death* usually results from progressive exhaustion, though it may be caused by various complications of the disease.

Pathological Anatomy. The principal pathological changes are exhibited in the blood and in the organs which elaborate the constituents of the blood. The *adenoid tissue* becomes greatly increased throughout the body, wherever it is normally situated, and in many localities where it intrudes itself into other tissues. The neoplastic substance may exist as a diffuse infiltration, or it may be circumscribed in the form of minute indurations that closely resemble tubercles or miliary carcinoma. The tubercular bacillus is, however, always absent, and the little tumors do not undergo caseation.

The *lymph glands* become greatly enlarged. At first they are soft, but become gradually indurated by the increase of connective tissue. The tracheal and bronchial glands, with the thyroid and thymus glands, become enormously increased in size. The whole length of the respiratory tract is frequently beset with adenoid masses that encroach upon the respiratory tract. A similar condition is exhibited by the adenoid tissues of the stomach and intestines. Sometimes the lymph follicles and patches of Peyer are in a condition that reminds one of the effects of typhoid fever. In the *serous cavities* of the pericardium, pleuræ, and peritoneum, there is frequently an abundant transudate, which is sometimes tinged with blood. The *heart* is pale and flaccid; the right ventricle sometimes contains blood which so nearly resembles pus that it suggests the idea of an abscess. The *spleen* is often im-

sely enlarged, sometimes weighing twelve to fifteen pounds. Its toneal capsule is often inflamed and adherent to the neighboring aces. When its connective tissue is greatly increased, the organ is siderably indurated, but it is soft when the principal change in- es a proliferation of the cells of the splenic pulp. Sometimes the nic follicles are greatly enlarged; hemorrhagic infarcts and great mulations of pigment have been noted, especially after malarial ction.

The *liver* is usually very much enlarged, through the increase of noid tissue which fills its interstices and frequently produces atrophy he parenchyma. The hepatic capillaries are often obstructed with rless corpuscles, and their walls are infiltrated with leucocytes. A ilar condition exists in the *pancreas*.

The *kidneys* are more or less infiltrated with adenoid tissue, espe- ly in the cortical portions of the organs. Leucocytes are very nerous in the neighborhood of the capillary bloodvessels. Occasion- amyloid degeneration of the kidney occurs. The *supra-renal cap-* s are sometimes so greatly distended by the development of adenoid ue that they are actually ruptured. Similar infiltration of the *brain* of its membranes sometimes exists. Hemorrhage is not uncom- . The tendency to hemorrhage, infiltration, and degeneration in retina has been already noted.

The *marrow of the bones* exhibits changes both in the spongy and he tubular bones. The fat cells disappear and are replaced by morrhagic extravasations and adenoid infiltrations. The substance he bone itself generally becomes rarefied and spongy.

Diagnosis and Prognosis. The disease may be easily recognized the aid of the microscope. From the transient leucocytosis that ompanies pregnancy, marasmus, and infective diseases, leukæmia y be easily distinguished by the greater increase of colorless cor- cles, and by its persistent and fatal course.

The *prognosis* is most unfavorable, since recovery scarcely ever urs.

Treatment. Since the disease is often excited by previous experi- ce of an infective disease or injury of the bones or spleen, it is desir- le that all such ailments should be efficiently treated, in order to vent so unfortunate a sequel. When leukæmia is actually recog- ed, general hygienic measures must be carefully employed. Iron, qui- e, strychnine, and cod-liver oil are useful agents for the promotion healthy nutrition. Phosphorus and arsenic sometimes afford good ults, but in the vast majority of cases whatever relief is obtained can only temporary in its duration. The inhalation of oxygen, trans- ion of blood, injection of ergotine, arsenic and other drugs into the een itself, and the application of electricity, have all been attempted hout any satisfactory result. The spleen itself has been removed, with an almost invariably fatal termination.

Pseudo-leukæmia.

This disease (Hodgkin's disease of the English, Adénie of the French) ely resembles leukæmia in the majority of its symptoms and in its

clinical development, but differs from it in the fact that the colorless corpuscles of the blood are not increased in number, and that the uric acid in the urine exhibits no increase in quantity.

ETIOLOGY. *Pseudo-leukæmia* is frequently due to the same causes that produce or excite leukæmia, but in many instances it is developed without any discoverable cause. The disease is more frequent among men than among women; it may occur at all ages, but is most commonly observed during early adult life, or in old age.

PATHOLOGICAL ANATOMY. The pathological changes that occur during the course of *pseudo-leukæmia* are identical with those which have been already described in connection with leukæmia. Only in the blood does a difference exist. The enlarged lymph glands are at first soft and yielding, but they become indurated by reason of the growth of connective tissue. Caseation, suppuration, and amyloid degeneration may occasionally involve the enlarged glands.

The points of resemblance between pseudo-leukæmia and leukæmia are so numerous that many pathologists incline to the belief that they are merely varieties of the same disease. The normal condition of the white blood-corpuscles has been ascribed to obstructive changes in the lymph glands by which the escape of leucocytes or lymph corpuscles and their entrance into the blood have been prevented.

SYMPTOMS. Pseudo-leukæmia may exist in three principal forms: the splenic, the lymphatic, and the myelogenic. In the *splenic form* the spleen is greatly enlarged; the patient becomes very anæmic; the red corpuscles are greatly diminished in number, and exhibit deformity and reduction in size. The amount of hæmoglobin is somewhat less than one-half of the normal quantity; the urine exhibits no marked change.

FIG. 123.



Pseudo-leukæmia. (RUSH MEDICAL COLLEGE CLINIC.)

In the *lymphatic form* of the disease the lymph glands are generally enlarged. The process begins in the glands of the neck, and extends to all the lymph glands of the body. The enlarged glands under the

an be distinctly felt under the skin, sometimes extending in a to the clavicle, or forming a hideous collar around the whole cirrence of the neck; they are somewhat movable and separate from nother, like grapes in a cluster. (Fig. 123.) In the earlier of growth the glandular enlargements are soft, and frequently it rapid variations in size.

e *myelogenic form* of pseudo-leukæmia is very rare, and very little own regarding its nature.

e disease is usually very tedious in its course, lasting for a numf years, though it is usually less chronic than leukæmia. The ss of glandular enlargment is frequently accompanied by fever, ally when a new cluster of glands is invaded. In acute cases ring the spleen and internal lymph glands, the symptoms may be imes mistaken for those of typhoid fever.

e consequences of glandular enlargement in pseudo-leukæmia are cal with those which have been already described in leukæmia. e tendency to *cutaneous eruptions* and *lymphoma* is also similar e two diseases. Occasionally the *skin becomes pigmented* in a er similar to what is observed in Addison's disease. A gradual ition to the development of complete leukæmia is not an uncomevent.

AGNOSIS AND PROGNOSIS. The disease may be easily recognized lifferentiated from leukæmia by the aid of the microscope. The *osis* is identical in the two diseases.

EATMENT. The same measures that are useful in the management kæmia should be adopted for the treatment of pseudo-leukæmia. most successful form of internal medication consists in the nistration of arsenic, and in the injection of Fowler's solution into ubstance of the enlarged lymph glands. By this method cure of lisease has been occasionally reached. The removal of enlarged ls by surgical interference is scarcely practicable, since it is impos- to reach any but the most external tumors. Lately the use of soap has been recommended; it should be dissolved in warm , and rubbed into the back and limbs for twenty minutes twice a . Electricians have reported favorable results from the applicaof strong faradic currents to the enlarged lymph glands, but in ajority of cases all forms of treatment meet with equal discourage-

gressive Pernicious Anæmia—Anæmia Progressiva Perniciosa.

TIOLOGY. *Pernicious anæmia* is characterized by a progressive almost invariably fatal impoverishment of the blood. The disease be of *primary* origin when it occurs without apparent cause, may be the *secondary* consequence of mental and physical overion, or of other morbid causes. Residence in unwholesome quarters, pation in ill-ventilated and unhealthy factories, and insufficient have been assigned as causes of the disease. It sometimes occurs g the course of pregnancy, or after parturition, and it may follow ic diarrhœa or other diseases that are accompanied by wasting arges.

The geographical distribution of the disease exhibits considerable variations which are probably dependent upon the social condition of the population. With the exception of those cases which depend upon pregnancy and childbirth, the disease occurs with equal frequency among males and females. It is most commonly observed during adult life.

Symptoms. The majority of the symptoms of *pernicious anæmia* are dependent upon impoverishment of the blood. The disease ordinarily commences in an insidious manner, indicated by excessive fatigue after slight exertion, copious perspiration, and shortness of breath. Palpitation of the heart, faintness, and dizziness are not uncommon; the patient becomes paler and weaker until he can no longer remain upon his feet. Sometimes the skin exhibits a peculiar gray or brownish color, and the whites of the eyes present a slightly yellowish tinge. Perspiration ceases, and the surface of the body becomes dry and scurfy; the hair loses its glossy smoothness, and frequently falls out; the nails become thickened and brittle; in many instances subcutaneous hemorrhages occur; these are most abundantly distributed over the lower extremities, though visible elsewhere, and upon the surface of the mucous membrane of the mouth, and into the internal organs of the body; not unfrequently the face and hands become œdematous; chemosis is sometimes developed; the serous cavities are also occupied by a moderate amount of transuded liquid which may be slightly tinged with blood pigment; the subcutaneous layer of fat is usually, though not always, well developed; the muscles are ordinarily flaccid, and sometimes sensitive to pressure; in like manner the bones, for example the sternum, are occasionally sensitive to pressure; the respiratory organs, in uncomplicated cases, exhibit no characteristic disorders, aside from the dyspnœa that is occasioned by a deficiency of red blood-corpuscles; palpitation of the heart is not uncommon; the pulse is usually weak and rapid; sometimes dilatation of the heart may be discovered; anæmic murmurs are audible over the cardiac area and along the course of the large arteries and veins; the bodily temperature frequently remains normal, but sometimes it is considerably elevated; this febrile movement exhibits no regularity, and is frequently paroxysmal, constituting the characteristic fever of anæmia; the intellectual faculties often remain unchanged throughout the course of the disease, but in many instances the patient lies in a condition of semi-consciousness, exhibiting a sluggishness and torpor from which he is with difficulty aroused; sometimes, however, delirium and maniacal excitement are manifested as a consequence of the ill-nourished and unstable condition of the brain; insomnia is a very common symptom, and the night-time is often particularly disturbed by the restlessness of the patient, who remains all day in a slumberous condition.

Microscopical examination of the blood shows that its elements are greatly reduced in number. In one case the red corpuscles numbered only 143,000, instead of 4 or 5,000,000, in the cubic millimetre. The surviving red blood-corpuscles are often considerably enlarged or diminished in size, and exhibit various deformities (poikilocytosis). The amount of hæmoglobin is greatly reduced in its aggregate, though it may be

ually increased in the individual corpuscles. The proportion of iron lso less than half the normal quantity.

The *alimentary canal* exhibits notable disorders. Hemorrhage and eration within the cavity of the mouth are not uncommon. The ath is usually very offensive. Appetite is generally lacking, but etimes the opposite condition of hunger and thirst exists. The nach is often sensitive to pressure, and exhibits all the symptoms of onic indigestion. Sometimes there is vomiting, and blood may ompany the discharges; in such cases bloody diarrhœa is not un-mon. The *spleen* is frequently enlarged. The *urine* varies in ntity and in quality; occasionally it contains blood and traces of min, but there is no uniformity in the changes that are observed in nection with the urinary secretion.

Transient disturbances of the *peripheral nerves* are sometimes ob-ed; these assume a paretic, spasmodic, or a paræsthetic character. metimes the patellar reflex is absent. Sudden deafness, blindness, oss of other special senses, sometimes occur. These accidents may of a purely functional character, and transient in their duration, or y may result from actual hemorrhage. Retinal hemorrhages are quently present, though they do not necessarily occasion loss of sight. asionally the retina becomes œdematous, and the phenomena of ked disk are developed.

The *progress of pernicious anæmia* is sometimes very rapid. The ease may complete its course in a few weeks, or it may linger for eral months, or even longer. Sometimes alternate remissions and cerbations follow one another, but in the majority of cases a fatal mination is reached at last. *Death* sometimes occurs as a conse-nce of gradual exhaustion; in other cases it is preceded by con-erable elevation of the temperature; but sometimes an excessive pression of the temperature is observed. Death is often preceded by opious perspiration that exhales a cadaveric odor.

Sometimes pernicious anæmia develops the symptoms of *leukæmia*, it may be associated with *sarcomatous* or *carcinomatous* growths in ferent parts of the body.

Pathological Anatomy. The most characteristic changes that are duced by progressive pernicious anæmia are *capillary hemorrhages*, ich may occur only in the organs and tissues of the body; *fatty eneration* caused by imperfect oxidation; and general *impoverish-nt* of the *blood*. The amount of *subcutaneous fat* is increased, and s rarely diminished in the internal organs. A small amount of um is usually present in the *serous cavities;* it may be either clear inged with blood, or of a yellowish color, even though no signs of ndice be present. The *heart* is usually empty, flaccid, and small, ugh sometimes it is enlarged and dilated; in many cases its muscu-substance appears streaked or spotted with yellowish masses which microscope exhibits in a condition of fatty degeneration. The *ves of the heart* remain unchanged, notwithstanding the endocardial rmurs that are audible during life. The large *bloodvessels* are ually in a normal condition, though sometimes they are atheromatous. th the exception of interstitial hemorrhages, the *lungs* present little

departure from health. The general tendency to œdema is sometimes manifested by an *œdema* of the *glottis*. The *spleen* and the *liver* are frequently enlarged. The *gall bladder* is often distended with dark-colored bile. The *cells of the liver* are sometimes loaded with fat, and the organ contains an excessive amount of iron, apparently derived from the destruction of the red corpuscles of the blood. The spleen also contains a similar excess of iron. The mucous membrane of the *stomach* and *intestines* is œdematous, and exhibits numerous capillary hemorrhages. The *lymph follicles* are distended; the *gastro-intestinal glands* frequently exhibit fatty degeneration of the glandular epithelium, and subsequent atrophy, which must not be mistaken for the primary cause of the disease. The *mesenteric glands* are often enlarged, and the *pancreas* presents considerable swelling, together with interstitial hemorrhages and fatty degeneration of its glandular epithelium. Essentially the same condition exists in the substance of the *brain* and of the *spinal cord*. The *ganglia* of the *sympathetic nerve* exhibit numerous evidences of fatty degeneration of the nerve fibres and ganglionic cells, together with proliferation of the connective tissue. The *peripheral nerves* escape without characteristic changes. The condition of the *retina* has been described. The *marrow of the bones* is frequently unchanged, but sometimes it is the seat of interstitial hemorrhage, and the fat cells become atrophied and replaced by red lymph-cells like those which constitute the red marrow in the spongy bones.

The *essential nature* of progressive pernicious anæmia remains unexplained. The majority of the pathological changes and symptoms are dependent upon impoverishment of the blood, but the cause of that impoverishment is not yet understood. It has been assumed that the disease is in some way connected with the blood-making organs, notably with the marrow of the bones, which furnish to the blood imperfectly developed elements that undergo rapid destruction in the liver and spleen. The lack of uniformity in the condition of the osseous marrow is, however, an obstacle to the acceptance of the opinion that these changes are anything more than the secondary consequences of the disease itself.

Diagnosis. It is not so easy to differentiate progressive pernicious anæmia in the early stage of the disease. *Incipient cancer* or *pulmonary consumption* may give rise to almost identical symptoms. *Chlorosis* can usually be distinguished by the fact that it is a disease which almost invariably exists in the female sex, and is originated at the age of puberty; it is also free from fever, and usually recovers under judicious treatment. In localities where exists the *intestinal parasite*, *anchylostomum duodenale*, it is necessary to remember that its presence produces most profound anæmia. It has been alleged that a severe form of anæmia may be produced by the growth of *bothriocephalus latus* and *bacterium termo* in the intestines, and that the disease is readily cured by the expulsion of these parasites. When anæmia is accompanied by a fever, it is sometimes difficult to distinguish it from *typhoid* or *remittent fevers*, and from *endocarditis* and *meningitis;* but the course of the disease generally renders an accurate diagnosis possible after a little time. *Chronic diarrhœa* and *tubercular diseases* pro-

ce intense anæmia, but these conditions can be easily recognized by ention to the general condition of the patient. *Primary atrophy of gastric glands* also results in a condition that closely resembles pro- essive pernicious anæmia, but this rare disease is sometimes assumed be the cause of pernicious anæmia, so that the relative position of e two diseases is not yet fully decided.

PROGNOSIS. The prognosis is most unfavorable; although remissions d apparent recovery are sometimes observed, it is probable that the ajority of cases reach a fatal termination.

TREATMENT. The patient should be placed under the most favor- le hygienic conditions. The most successful remedy is arsenic, which ay be administered in doses of four or five drops after each meal; it ust be administered with great perseverance for a long period of time. on is not always tolerated, and must be used with caution. The best reparations are the sulphate of iron in the form of Blaud's pills, or e tincture of the acetate of iron in doses of thirty drops after each eal. Phosphorus has been recommended, and in desperate cases the ansfusion of blood has been performed with temporary benefit. Irri- ation of the stomach is said to have accomplished wonderful cures, but is probable that the cases were simple forms of ordinary anæmia.

Chlorosis.

ETIOLOGY. *Chlorosis* rarely occurs except among young people of he female sex, during the first ten years after the age of puberty. The disease is widely diffused, and increases with the spread of civilization and its peculiar privileges and disadvantages. It is often associated with an imperfect development of the vascular apparatus, which involves a condition of general debility and a defective evolution of the sexual organs. The disease is frequently observed in families whose members exhibit a predisposition to pulmonary consumption, cancer, and nervous diseases.

A predisposition to the disease may be acquired through exposure to all forms of mental and physical depression. Sorrow, anxiety, over- work, unwholesome food, wasting discharges, and the wear and tear of emale life in an atmosphere of poverty and neglect, favor the acquisi- on of the disease.

SYMPTOMS. *Chlorosis* is usually developed in a gradual and insidi- s manner. It sometimes commences at the first menstrual period. he patient complains of fatigue, disinclination to exertion, excessive sire for sleep, shortness of breath, palpitation of the heart, dyspep- , and wandering pains in the different parts of the body. The enses are frequently irregular, scanty, and accompanied with pain. *xtreme pallor* is one of the earliest symptoms; the ears appear lorless; the lips, the conjunctiva, and the entire surface of the skin are ale, though sometimes the color assumes a slightly icteric or greenish nt. In certain cases the countenance presents a florid appearance on ccount of the thinness of the skin and the dilatation of its capillaries, ut an examination of the cavity of the mouth will speedily rectify

any diagnostic errors which have been thus originated. The perspiration is usually scanty, and the epidermis becomes dry and scurfy.

Despite the excessive impoverishment of the blood, the patient usually appears plump, and does not lose weight. The subcutaneous fat is often increased, by reason of the imperfect supply of oxygen to the tissues. Sometimes a moderate degree of *œdema* is visible about the face and upon the backs of the hands.

The *blood* appears light colored and watery. The white corpuscles are not increased in number. The red corpuscles exhibit great variation in size and form (poikilocytosis), and their number is often greatly diminished. The hæmoglobin exhibits a still greater degree of reduction. The amount of iron in the blood is also reduced in quantity. The albuminous constituents of the plasma are sometimes diminished, but are sometimes increased.

The *temperature* of the body is usually unchanged. Occasionally it is slightly elevated, but when decided paroxysms of fever exist, the case is probably one of pernicious anæmia. The subjective sensations of cold are greatly increased. It is difficult for the patient to keep warm. The *muscular apparatus* is flaccid and weak, so that every exertion becomes laborious and fatiguing. The *pulse* is small, soft and accelerated. The *voice* is frequently feeble and hoarse. *Catarrhal conditions of the respiratory passages* are not uncommon. Breathlessness is a frequent consequence of exertion, and is conditioned by the reduced capacity of the blood for oxygen. The *heart* beats rapidly, and feebly: anæmic murmurs are audible over its valves and along the course of the large arteries and veins. In many cases it is necessary to observe the course of the disease, and to perform frequent auscultation, in order to avoid the erroneous diagnosis of valvular disease.

Enlargement of the thyroid glands is not uncommon; when associated with a rapid pulse and with prominent eyeballs, the symptoms of exophthalmic goitre are closely counterfeited, if not actually present.

The *appetite* is usually diminished, though sometimes it is inordinate and capricious. The patient eagerly devours undigestible food or other articles of an inedible character, like chalk, slate-pencils, etc. (pica). An *offensive breath* is a common symptom, and various evidences of *dyspepsia* are commonly observed. *Gastralgia* is frequently experienced. The gastric juice is often deficient in hydrochloric acid. Digestion and absorption are retarded, and the bowels are usually constipated.

The *urine* is usually watery, and of a low specific gravity; it sometimes contains traces of albumin, but renal casts are absent.

The *menses* are generally suppressed; sometimes, however, they occur more or less regularly, but are associated with great pain; sometimes there is actual menorrhagia.

Associated with chlorosis may occur *every form of functional nervous disorder*. Hysteria is not uncommon; convulsions and paralysis are sometimes witnessed, and the phenomena of neuralgia, headache, spinal irritation, and neurasthenia are frequently observed.

The existence of chlorosis is sometimes accompanied by a predisposition to endocarditis, venous thrombosis, bleeding from the nose, consumption, leucorrhœa, erosion of the uterine cervix, and relaxation of

ligaments of the uterus, permitting displacement and flexion of the n.

he *duration of chlorosis* depends largely upon its causes. Some- s it is rapidly cured, but too frequently its consequences are greatly onged, and may become a permanent condition.

ATHOLOGICAL ANATOMY. The rare occurrence of death from rosis greatly interferes with the progress of knowledge regarding its iological changes. The universal *lack of blood* is very apparent, all parts of the body are unusually pale. The *heart* is usually small relaxed; sometimes the right ventricle appears relatively dilated; owish spots appear in its substance, which upon microscropical nination are shown to be the seat of fatty degeneration. The *aorta* ften imperfectly developed in size, so that it resembles one of the ries of the extremities, rather than the principal vascular canal of body. Its walls not infrequently exhibit patches of fatty degenera- . The *sexual apparatus* is often imperfectly developed. The breasts flaccid and small, and sometimes contain indurated masses which involve the entire gland. The *liver*, *kidneys*, *pancreas*, and *gas- intestinal glandular apparatus* are frequently in a condition of siderable fatty degeneration.

IAGNOSIS AND PROGNOSIS. Chlorosis can be distinguished from *ndary anæmia* by the history of the case, and by the condition of the ient. During the early stages of the disease the possibility of *latent sumption* and *cancer* should be kept in mind. The favorable results reatment, the absence of fever, and of retinal hemorrhages, distin- sh chlorosis from *progressive pernicious anæmia*. The absence of al casts from the urine differentiates chlorosis from *chronic nephritis*, n though traces of albuminuria and of œdema are present. The spect of recovery is good, though it is true that in many cases there sts a predisposition to pulmonary consumption and to endocardial eases.

TREATMENT. Nothing positive is known regarding the *essential ture of chlorosis*. It is, however, a matter of experience that the ease may be often prevented by attention to diet and hygiene. ough fresh air and exercise are of great benefit in cases of chlorosis, at caution is necessary in order to avoid fatigue from the excessive ployment of these therapeutic measures. In like manner, though l sponge baths and plenty of friction with rough towels are exceed- ly beneficial, the indiscriminate use of cold bathing upon the sea- st, and elsewhere, is often attended with unfavorable results.

Chief among the remedial agents that are useful in chlorosis may be ed the preparations of iron; these should be given in doses such as be tolerated, and their use must be continued for a number of aths. Among the best of the iron preparations are iron by hydro- , the lactate of iron, Vallet's mass, the sulphate of iron in the form Blaud's pills, the potassio-tartrate of iron, the tincture of the acetate ron, and the tincture of the perchloride of iron. Constipation of bowels should be relieved by the use of compound rhubarb pills, es and myrrh, or the granules of aloin, strychnine, and belladonna. ch benefit is often derived from the use of mineral waters that con-

tain iron. Of these the springs among the mountains of Virginia enjoy a well-deserved reputation. Among them may be mentioned the Rawley Springs, the Sweet Chalybeate Springs, the Rock Bridge Alum Springs, the Pulaski Alum Springs, the Bath Alum Springs, the Stribling Springs, the Church Hill Alum Springs, the Bedford Alum Springs, the Variety Springs, and the Shenandoah Alum Springs. In other parts of the United States, the Bailey Springs in Alabama; Fry's Soda Spring, the Geyser Spa, the Napa Soda Springs, and the Summit Soda Springs in California; the Stafford Springs in Connecticut; the Green Castle Springs in Indiana; the Catosa Springs, and the Madison Springs in Georgia; the Estill Springs in Kentucky; the Schuyler County Springs in Illinois; the Hopkinton Springs in Massachusetts; the Owosso Springs in Michigan; Schooley's Mountain Springs in New Jersey; Cooper's Well, and Ocean Springs in Mississippi; the Oak Orchard Acid Spring, and the Sharon Springs in New York; the Adams County Springs, and the Green Springs in Ohio; Cresson Springs, Blossburg Springs, and the Fayette Springs in Pennsylvania; the Montvale Springs, and the Beersheba Springs in Tennessee.

When chlorosis is associated with scrofula, the syrup of the iodide of iron should be given three times a day, in half-drachm doses; or pills of iodide of iron may be administered together with cod liver oil. When gastric disorders exist, iron can scarcely be tolerated. In such cases it is advisable to give ten drops of dilute hydrochloric acid in a wineglass of warm water, half an hour after each meal. When an inflammatory condition of the stomach does not exist, bitters like compound tincture of cinchona, and the compound tincture of gentian, are useful. Nux vomica and its preparations are also beneficial in such cases.

The question of marriage during chlorosis is frequently made prominent. While in many instances a happy marriage is followed by speedy recovery, in many other cases it appears to be a complete failure. It is probable that in such instances there is an insuperable defect in the structure of the vascular apparatus, and in the blood-making organs.

Melanæmia.

Etiology. The existence of *melanæmia* can only be determined by the aid of the miscroscope, which reveals the presence of numerous black granules of pigment in the blood. The cause of the disease is connected with *malarial infection*. Under the influence of malaria the red blood-corpuscles become disintegrated, and their pigment is discharged into the blood. The disease is not very common in temperate climates. It is usually observed in tropical countries where malaria exists in its most deadly forms. The occurrence of melanæmia is therefore dependent upon the concentration of the poison, and occurs only as a consequence of the severer forms of malarial fever. It is supposed that the infective parasite, by its action upon the red corpuscles, causes their disintegration, and the transformation of their hæmoglobin into pigment.

Symptoms and Diagnosis. The blood contains numerous *pigment*

s, which are either carried freely in the plasma, or are included
d cells, or spindle-shaped cells which resemble the endothelial
the splenic veins. Sometimes the granules are included in
masses of different shapes. These granules are intimately
ed with the presence of the *malarial plasmodium*, which is
d to constitute the infective agent of malaria. The recently
granules are of a brown or yellow color, which deepens into a
ıte color as their age increases. They do not contain iron.
any cases the pigment masses disappear very quickly after the
ıce of a febrile paroxysm; in other cases they continue to cir-
n the blood for a long period of time.
metimes happens that the presence of pigment causes no other
ns, and the disease can only be recognized by a microscopical
ıtion of the blood, which reveals the presence of pigment and a
ion of the number of red blood-corpuscles. In many instances
illaries in different parts of the body become obstructed with
t, and the symptoms of *blood stagnation* may be thus locally
ed. In this way is produced the peculiar yellowish-gray dis-
on of the skin that characterizes *malarial cachexia*. The
ns of the brain, *kidneys*, and *digestive organs*, are sometimes
rably impeded by these minute pigment embolisms, producing
ıe, dizziness, delirium, coma, and occasionally convulsions or
is. *Portal obstruction* is followed by diarrhœa, peritonitis,
tes. *Renal obstructions* occasion suppression of the urine, or
ıuria and hæmaturia.

IOLOGICAL ANATOMY. The *blood in the portal vein* is espe-
rich in pigment. The *spleen* and the *liver* contain large
ies of the substance, and are frequently enlarged and of a slate
y reason of the presence of coloring matter in the cells and
of the organs. The same thing is true of the majority of the
and tissues of the body, especially the brain, kidneys, lymph
marrow, and skin.

GNOSIS AND TREATMENT. *Melanæmia* is attended with con-
e danger in consequence of the intensity of the malarial infec-
which it is caused. The treatment requires large doses of
(30 to 60 grains per diem). After the symptoms of fever have
bdued, nitric acid or nitro-muriatic acid may be given, in doses
lrops of the undiluted acid in a glass of water, three times a
This treatment should be continued for a month or six weeks;
ossible a change of air should be secured.

Purpura—Purpura Simplex.

PTOMS AND DIAGNOSIS. *Purpura* consists in the occurrence
ute hemorrhages into the skin, especially upon the surface of
and upon the backs of the hands. These spots do not itch,
not disappear on pressure. *Their color* is at first purple, then
ly fading into a brownish, greenish, and yellowish color, as the
pigment becomes transformed at the seat of extravasation.
nes there is a slight febrile movement, together with symptoms

of gastric disorder and universal discomfort, accompanying the development of the eruption. In other cases it produces no constitutional disturbance. The *duration of the disease* is prolonged through one or two weeks, and sometimes successive crops of the eruption make their appearance.

ETIOLOGY. Very little is known regarding the causes of purpura. It is sometimes observed in connection with *anæmia* and *tuberculosis;* in other cases it follows one of the *infective diseases;* or it may be connected with the *appearance of the menses.*

PROGNOSIS. Recovery is the rule. Only in rare instances do the hemorrhagic spots increase and assume alarming proportions. In such cases death sometimes occurs within a few days.

TREATMENT. Mild cases require no specific treatment beyond rest and good diet. When the disease occurs after other infective diseases, or in connection with anæmia, the general treatment of such conditions is indicated.

Rheumatic Purpura—Purpura Rheumatica.

SYMPTOMS AND DIAGNOSIS. In this form of purpura, *inflammatory swelling of the joints*, like that of rheumatism, is associated with the cutaneous eruption. In the majority of cases the eruption is preceded by a loss of appetite, depression of spirits, and slight symptoms of fever. After a few days the joints and the muscles become painful and slightly swelled. These symptoms are soon followed by the appearance of *purpuric patches*, of variable size and intensity, upon the surface of the skin. The lower extremities are principally involved, though the exanthem usually appears also upon the body and upper extremities. Sometimes the patches are slightly elevated, and an eruption of urticaria may occupy the intervening spaces. In many instances a certain amount of *œdema* is visible about the eyelids and upon the lower extremities. *Feverish symptoms* are sometimes present, but are frequently absent. As the eruption appears, the pain and swelling of the joints subside. In the course of a week or ten days the extravasated blood is gradually absorbed, and the eruption disappears after changing color from red to brown, green, and yellow. Sometimes the *spleen* is somewhat enlarged. Occasionally *albumin* is present in the urine.

The *disease continues for one or two weeks*, and relapses are not uncommon, so that sometimes its occurrence is prolonged for many months. Under such circumstances a high grade of anæmia is usually developed.

Hemorrhage from the mucous membranes seldom occurs, but it has been sometimes observed, together with hæmaturia and gangrene of the fauces, followed by a fatal result. These cases manifest an apparent relationship with *purpura hæmorrhagica.*

ETIOLOGY. The disease is most frequently observed among males during the first fifteen years of adult life. It is rare among children. It is especially frequent among persons of an anæmic and enfeebled constitution, especially if they have previously suffered with rheumatism, malarial fever, pulmonary consumption, or cardiac disease.

ong females it is sometimes experienced shortly before the occur-
e of the menses.

ATHOLOGICAL ANATOMY. Very little is known regarding the patho-
al changes that are produced by the disease. The *joints* contain
excessive amount of clear synovial fluid, and the *vessels of the*
vial membranes are injected and ruptured at various points.
illary hemorrhages also exist in the muscles that move the affected
ts.

ROGNOSIS AND TREATMENT. The *prognosis* is almost invariably
rable. Salicylic acid and its salts do not seem to exert that influ-
over the symptoms which they produce in cases of ordinary acute
matism. The *special treatment* is principally symptomatic, and in
re cases is identical with the treatment of purpura hæmorrhagica.

Purpura Hæmorrhagica.

TIOLOGY. The disease occurs more frequently among females than
ng males. It is most common during the first five years after the
of puberty, and especially among individuals of a delicate constitu-
. It is a disease of cold weather and harsh climates, where it exists
e frequently than in milder regions and seasons. It is often
ptly originated by exposure to cold and wet, together with insuf-
nt and unwholesome food. It is sometimes experienced during the
od of convalescence from severe infective diseases, like typhoid
r, scarlet fever, malarial fever, syphilis, and tuberculosis. It is
sionally encountered during the period of pregnancy, or after child-
h, and its occurrence is sometimes excited by the medicinal use of
cury, phosphorus, and iodide of potassium.

YMPTOMS. In the majority of cases the disease is ushered in with
of appetite, general prostration, disturbances of the alimentary
al, and a slight fever. These symptoms are soon followed by the
earance of hemorrhagic spots upon the lower extremities, and
ending to the body and upper extremities, but sparing the face.
e hemorrhagic spots are usually petechial in their character, but
metimes they coalesce and form patches of considerable size, present-
the appearance of wheals and stripes (vibices). Like other forms
purpura these effusions gradually change color, assuming different
des of red, purple, blue, green and yellow. Sometimes the epi-
mis is raised by the effusion, forming a blood-filled vesicle or bulla
ich may become gangrenous. Hemorrhages also occur sometimes
m the cavity of the mouth and from all of the mucous membranes of
body. *Intestinal perforation* and *peritonitis* are sometimes pro-
ed by gangrenous ulceration, excited by the formation of a hemor-
gic infarct in the wall of the intestine. Hemorrhages into the
-conjunctival tissue, into the retina, and into the brain itself, are
metimes observed.

The *blood* presents no uniform characteristics. Not unfrequently
red blood-corpuscles are diminished in number, and the colorless
puscles are multiplied. The amount of hæmoglobin in the corpuscles
ot diminished. In some cases the coagulability of the blood is de-
sed.

In certain cases the symptoms of *constitutional disturbance* are very slight, but in others there is high fever and great prostration. *Hemorrhage into the kidneys* sometimes causes inflammation of those organs, so that the symptoms of nephritis become prominent as the symptoms of purpura subside. Occasionally the disease terminates with delirium and coma or convulsions.

The *duration of the disease* varies from two to six weeks, though *death* sometimes occurs in the course of a few days; while in other instances the case may be prolonged for many months. Relapses are not uncommon.

PATHOLOGICAL ANATOMY. The tissues and organs of the body generally exhibit considerable *anæmia*. *Hemorrhages* are often visible in the internal organs and serous surfaces. The connective tissue of the muscles, the fasciæ, tendons, and periosteal structures usually escape the effects of hemorrhage. A certain amount of fluid, sometimes tinged with blood, exists in the *serous cavities* of the body. The *spleen* is frequently enlarged, and sometimes contains hemorrhagic infarcts. Microscopical examination sometimes reveals an *amyloid degeneration* of the *capillary walls*, and the effort has been made to explain the occurrence of hemorrhage by this fact. The *lymph glands* are sometimes infiltrated with pigment derived from the degenerated blood corpuscles.

Nothing is known with regard to the *actual cause of the disease*, though many are inclined to regard it as a consequence of some form of infection.

DIAGNOSIS. The disease differs from other forms of purpura through the greater intensity of its symptoms. *Purpura simplex* principally involves the external surface of the body. *Purpura rheumatica* is associated with articular changes. *Scurvy* is characterized by a peculiar inflammation and swelling of the gums. *Hæmophilia* differs from purpura in the fact that it is a congenital and permanent condition, and is frequently of hereditary origin. The acute *hemorrhagic exanthemata* are characterized by high fever, and by the specific symptoms peculiar to each disease.

PROGNOSIS. *Purpura hæmorrhagica* is seldom dangerous, except in the cases of pregnant and parturient women, who are exposed to the risk of fatal hemorrhage.

TREATMENT. Rest in bed is an important factor in the treatment of purpura, since hemorrhage of a dangerous character is sometimes provoked by premature return to active habits. The diet must be light and cooling, and the bowels should be opened daily. In ordinary cases aromatic sulphuric acid, in doses of ten drops every four hours, will prove a sufficient remedy. If signs of debility make their appearance, the compound tincture of cinchona may be given, in drachm doses every four or five hours; or tonic doses of quinine and sulphuric acid:

R.—Quin. sulph. gr. xxxij.
Strych. sulph. gr. j.
Acid. sulph. arom. ʒj.
Syr. zingiber. ʒij.
Aq. destill. ʒxxix.—M.

S.—Give one teaspoonful in a wineglass of water every four hours.

er remedies, *e. g.*, ergot, acetate of lead, oil of turpentine, and the ent preparations of iron, have been employed without any par- ly good effect.

Scurvy—Scorbutus.

OLOGY. *Scurvy* is a disease that is caused by defective nutrition. mes this is a consequence of an *insufficient supply of food.* In cases it is dependent upon the use of *tainted articles of diet;* the frequency with which the disease occurs during famine or the inhabitants of beleaguered cities in time of war. An *im- and vitiated water-supply* is supposed to contribute toward the ence of the disease. In many cases, however, scurvy occurs in uence of an *improperly selected diet*, even though the quantity e quality of the food be all that can be desired. This has been the nt experience of seafaring people who are for a long period of eprived of fresh vegetables, though abundantly supplied with meats and bread. In many cases a deficiency of fat food has ssigned as a cause of scurvy.

effects of insufficient or improper food are greatly aggravated by re to fatigue and cold and wet. For this reason the hardships ilor's life are particularly favorable to the occurrence of scurvy. cold, northern climates that the disease is most commonly en- red, though the experiences of the British navy in past ages have that scorbutic epidemics may rage with the utmost severity with- tropics.

more frequent occurrence of scurvy in the male sex, during ive years of middle life, is simply a consequence of the fact that re to its causes is most commonly experienced by men during st enterprising period of their existence. The disease is less nt among robust and vigorous individuals of the upper classes mong the poorer members of society. The intemperate, and those ave been debilitated by malaria, syphilis, and other exhausting s, are particularly liable to an attack of scurvy.

disease is not limited to the ranks of soldiers and sailors. It ccur upon land as well as upon sea, wherever poverty and misery evalent.

PTOMS. The outbreak of scurvy is usually preceded by the pment of *anæmia and debility*, which gradually increases until haracteristic symptoms of the disease make their appearance. g the *earliest symptoms* is an inflammatory swelling of the gums, become soft, spongy, and swelled around the teeth. This symptom ot make its appearance in young children and toothless old peo- The swollen gums exhibit a bluish color, and bleed very easily. eth become loosened in their sockets, and frequently fall out. In instances ulceration and necrosis of the inflamed tissues take so that the mouth becomes filled with putrefactive microörgan- nd the breath exhales a frightful fetor. This process rarely s to the lips and cheeks, since they are not exposed to the injuries ch the swelled and bleeding gums are exposed during the act of ation.

While the inflammatory processes are progressing in the mouth, *hemorrhages* make their appearance in the *skin and subcutaneous areolar tissue*. The hemorrhagic spots are most numerous upon the lower extremities, but they also appear upon the body and upper extremities, scarcely ever invading the face. Any unusual pressure upon the surface of the skin, or compression of the flesh, is liable to be followed by interstitial hemorrhage. Sometimes vesicles and bullæ that are filled with blood make their appearance. Their rupture is followed by ulceration, and sometimes by gangrene. Subcutaneous hemorrhages are frequently very extensive, especially when provoked by any violent exercise or traumatism. Sometimes they are followed by thickening of the connective tissue, and by the formation of permanent indurations and adhesions between the skin and the underlying structures, so that the patient may be more or less crippled by contractures and deformities involving the extremities. *Club-foot* is sometimes thus produced. In other cases the *joints* become ankylosed, and the *muscles* undergo atrophy. When the skin gives way over one of these hemorrhagic effusions, extensive ulceration may exist for a long period of time. These formidable lesions are most common in the lower extremities. Sometimes the roots of the nails become ulcerated, and the nails themselves are thrown off.

Copious *hemorrhage* from any portion of the *mucous surfaces* of the body is a not uncommon event. Sometimes the *joints* become swelled and painful, and their inflammation may be followed by destruction of the articular surfaces and by ankylosis. Occasionally hemorrhage takes place under the *periosteum* and into the *epiphyses of the bone*. The *serous cavities* of the body may also be invaded by hemorrhagic effusion and inflammation. The chambers of the *eye* and the *sub-conjunctival tissues* sometimes exhibit the same hemorrhagic condition, and in certain cases the eyesight is permanently lost through disorganization of the eyeball. The phenomenon of *hemeralopia* is not uncommon, but its cause has not been explained.

The evolution of the disease is accompanied by increasing *debility* and *cachexia*. *Fever* does not often occur, unless excited by the occurrence of inflammation and the formation of abscesses. The usual consequences of *anæmia* are exhibited by the *heart*. The *spleen* is sometimes enlarged, and diarrhœa or dysentery frequently exists. The *urine* is generally reduced in quantity and contains albumin; its specific gravity is frequently low, and its chemical composition is quite variable. The *blood* frequently contains very little fibrin. The colorless corpuscles are usually increased, while the red corpuscles are considerably diminished in number.

The *course of the disease* generally manifests a subacute and chronic form. It may last for many weeks, though sometimes a *fatal termination* is quickly reached. This may result from exhaustion, or from excessive effusion into the pleural or pericardial cavities. It may result from pneumonia, or from uncontrollable hemorrhage, or from the occurrence of septicæmia. The progress of *recovery* is usually very tedious and frequently interrupted by relapses, unless the most favorable conditions are present. *Pneumonia* is probably the most common compli-

ion of scurvy. It frequently originates in hemorrhagic infarcts hin the lungs, and it tends to assume a low form that sometimes minates in gangrene. *Dysentery* and other *infective diseases* are en associated with scurvy.

PATHOLOGICAL ANATOMY. *Rigor mortis* is but slightly developed er death, and decomposition advances rapidly. The *hemorrhagic usions* that take place under the skin, and elsewhere, remain dis- ctly visible, and sometimes the process of transformation of the exu- te into connective tissue appears considerable advanced. *Fractures* often found disunited through absorption of the newly formed bone, d the callus disappears if the fracture be recent. *Lymphoid cells* predominant in the marrow of the bones. The *articular cavities* ntain serous or sanguinolent liquid; hemorrhage and softening are ible in the articular cartilages and synovial membranes, and occasion- y a purulent exudation is discovered. A similar condition is pre- nted by the other *serous cavities* of the body. The *blood* is thin, and es not readily coagulate; its quantity is often greatly reduced, and *tty degeneration* is frequently observed in different organs as a con- quence of the impoverished condition of their nutrient fluid. The *art* is soft and pale, and often exhibits circumscribed regions of fatty generation. Sometimes inflammatory changes involve the cavities d valves of the organ, and hemorrhages are common beneath its epi- rdial investment. Similar hemorrhages are often visible under the ucous surfaces of the air-passages. The *lungs* are sometimes œdema- us, or inflamed as a consequence of pneumonia or hemorrhagic infarc- on which occasionally leads to pulmonary gangrene. The *spleen* is ually enlarged, and frequently contains hemorrhagic infarcts. A milar tendency to hemorrhage is apparent in the mucous membrane the *stomach* and *intestines*. Follicular ulceration and necrosis are so a common incident. The *liver* is fatty, and frequently invaded by attered points of hemorrhage. The *kidneys* usually escape serious jury, but the universal tendency to hemorrhage is apparent in the ourse of the urinary passages.

The real *nature of scurvy* is unknown. The opinion has been ex- ressed that it is an infective disease, but no satisfactory evidence of his has yet been forthcoming. Among the most plausible explana- ons is that which ascribes the disease to a deficiency of the organic alts of potassium in the diet. But while the fact of their reduction is ue, the connection of this fact with the phenomena of the disease has ot yet been clearly established.

DIAGNOSIS AND PROGNOSIS. *Scurvy* is a disease that can be rcely mistaken for anything else. The condition of the gums is ghly characteristic, and resembles nothing else. The *prognosis* is orable when proper food can be secured, but in advanced cases, ecially if complicated by other diseases, a fatal result is not un- mon.

TREATMENT. The most favorable results in the management of rvy are obtained through the adoption of prophylactic measures. If olesome water, fresh meat, and an abundant supply of vegetables, ecially potatoes, are furnished, the existence of scurvy is rendered

impossible, even during long voyages. Apples, oranges, cabbage, onions, and all kinds of fresh fruits and vegetables, are particularly useful. A daily ration of lime-juice is an efficient preventive of the disease. It is frequently served out to seafaring men, together with a small quantity of spirits, to make it more palatable. It is also a matter of great importance to avoid exposure to wet and cold, and to procure sleep in dry and well-ventilated apartments. When the disease has been already developed, it is sufficient to supply the necessary articles of food, in order to witness rapid recovery without other remedies. The various plants of the cruciferous order are all useful, and the narratives of ancient mariners abound in references to the good effects of scurvy-grass, pepper-grass, mustard, water-cress, cabbage, cauliflower, and even green grass itself. The different organic salts of potassium have also been employed, though with rather indifferent success. During convalescence various preparations of iron, quinine, strychnine, and other bitters, are useful. Ulcers upon the external surface require ordinary surgical treatment. The mouth should be frequently cleansed with a solution of chlorate of potassium or of permanganate of potassium. Painful ulceration of the gums is sometimes benefited by the local application of nitrate of silver.

Paroxysmal Hæmoglobinuria—Hæmoglobinuria Paroxysmalis.

Etiology. *Paroxysmal hæmoglobinuria* is usually observed in the male sex alone. Its causes are not well understood. It sometimes follows rheumatism, intermittent fever, syphilis, Bright's disease, debauchery, disturbances of menstruation, mental agitation, and other causes of depression. The disease is usually experienced during the cold months of the year, and its paroxysms are frequently excited by exposure to cold, or by immersing the hands or feet in cold water.

Symptoms and Diagnosis. *Paroxysmal hæmoglobinuria* is characterized by the appearance of hæmoglobin in the urine. This occurs intermittently, and usually follows exposure to cold. During the intervals between the paroxysms, the urine exhibits no unusual departure from the normal standard, though sometimes a transient albuminuria has been noted. The *invasion of the paroxysm* is accompanied by sensations of cutaneous irritation, with pain in the joints, sensitiveness to pressure over the liver and kidneys, and a feeling of general discomfort which culminates usually in a chill, followed by fever and perspiration that continues for a few hours, and then gradually subsides. The *duration of the paroxysm* may vary from two or three hours to a week. It is not unusual to see an eruption of urticaria upon the skin during the attack. Occasionally the temperature is reduced below the normal standard, and sometimes an icteric tinge appears upon the skin and conjunctiva. If blood be drawn and permitted to coagulate, the serum is stained with hæmoglobin, showing that many of the red blood-corpuscles have undergone dissolution, and have discharged their coloring matter into the plasma. The red corpuscles also exhibit great variation in size and form. It appears that the blood-making organs furnish corpuscular elements which too easily break down and give up

eir hæmoglobin. Very considerable anæmia is thus sometimes oduced.

PATHOLOGICAL ANATOMY. With the exception of the changes eady described in the *blood*, very little can be learned from post-rtem examination. The *kidneys* usually appear enlarged and peræmic, but otherwise exhibit nothing unusual save an occa-nal deposit of pigment in the renal epithelium.

PROGNOSIS. The disease usually recovers under treatment; still, apses are often experienced, rendering the prognosis somewhat certain.

TREATMENT. The avoidance of exposure to cold and fatigue consti-es the most important prophylactic measure. If the disease appears be dependent upon the preëxistence of syphilis, favorable results are en obtained from anti-syphilitic treatment. Anæmia should be ated with iron, etc., as indicated by the symptoms.

Hæmophilia.

ETIOLOGY. *Hæmophilia* is a condition characterized by a congeni-l or hereditary predisposition to uncontrollable, and, frequently, fatal emorrhage. The predisposition is usually hereditary, so that certain milies are by the public recognized and nicknamed as *bleeders*, by ason of this peculiarity which is transmitted from generation to eneration. The predisposition is usually manifested by the male embers of such families, though it is transmitted chiefly through the male sex. Sometimes the predisposition is transmitted indirectly om the grandparents to the grandchildren, while the intermediate eneration manifests no symptom of the tendency. It has also been oted that when a male bleeder marries a healthy wife, his descendants sually escape the incidence of hæmophilia, while if a healthy man is nited with a woman from an hæmophilic family, though she may ever experience the disease, her descendants manifest the predis-osition.

Though the disease is usually hereditary, it sometimes originates as *congenital affection*. The cause of such congenital predisposition is ot understood, though it has been ascribed to various unfavorable con-tions of health on the part of the parents. Occasionally hæmophilia ems to originate spontaneously at a somewhat advanced period of e, but it is probable that in such cases a predisposition, either heredi-ry or congenital, had been overlooked by reason of the absence of citing causes for its manifestation.

SYMPTOMS AND DIAGNOSIS. The existence of *hæmophilia* is usually scovered through the occurrence of obstinate and profuse capillary morrhage after some slight injury or surgical operation. Among males it is sometimes the cause of excessive menstruation, and it may termine fatal hemorrhage at the time of childbirth. Individuals o manifest the hæmophilic predisposition are usually of a delicate ganization, slender frame, blond complexion, blue eyes, white teeth, n skin through which the bloodvessels are distinctly visible, and they anifest a remarkable tendency to blushing upon the slightest provoca-

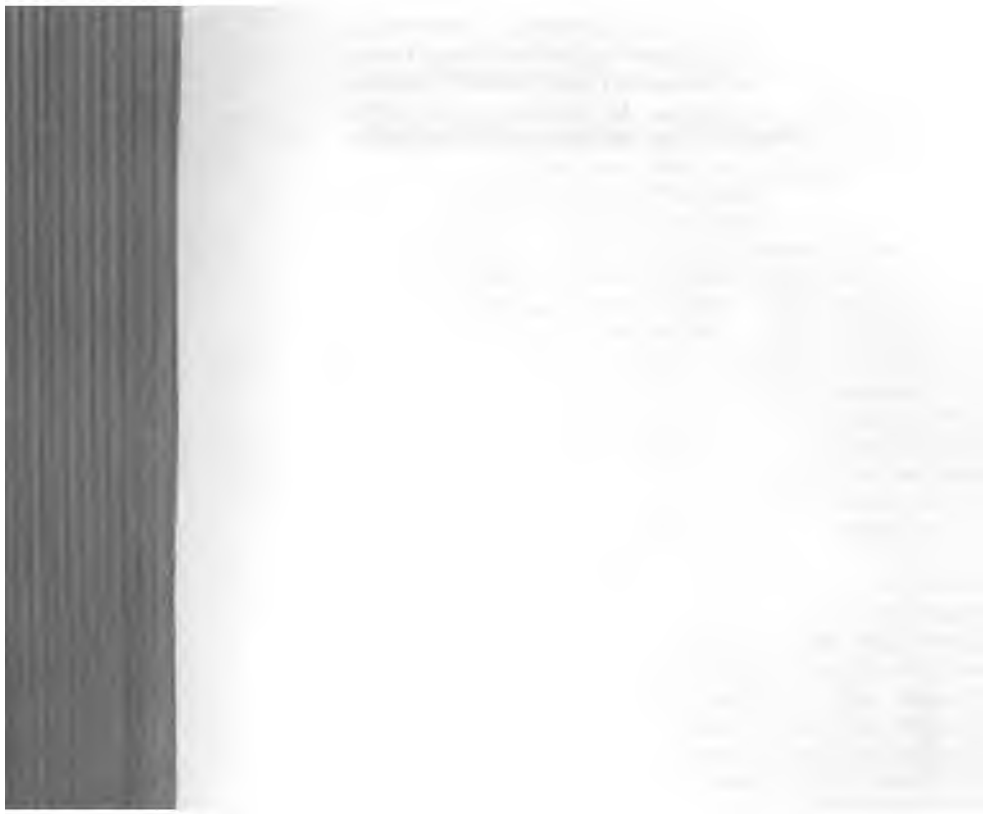
tion. The disease is frequently associated with pain in the muscles, and neuralgic sensations in the teeth and in the joints. Excessive bleeding from the nose is not an uncommon event. The disease sometimes shows itself at the time of birth in the form of persistent hemorrhage from the divided cord, though this may also result from a peculiar form of bacterial infection. The occurrence of protracted hemorrhage is accompanied by the usual symptoms of anæmia and exhaustion. The blood is most frequently discharged from the nose or from the skin. Hemorrhage from the internal mucous membranes is less frequently observed. Sometimes blood accumulates in the cavities of the joints, and may become the cause of their disorganization. When hemorrhage takes place beneath the skin the effusion may become purulent, and the affected tissues may break down into a condition of gangrene.

Slight injuries are frequently followed by persistent and even fatal hemorrhage. In this way the extraction of a tooth may be followed by death. Among the Jews circumcision has in like manner led to a fatal result. The application of leeches or cups, and all incisions of the skin, are liable to be followed by a dangerous flow of blood which oozes from the capillaries, without the implication of any considerable arterial vessel. It has been observed that slight wounds are more dangerous than those of greater extent, and hemorrhage has sometimes been arrested by the simple process of enlarging the original wound. The operation of vaccination, fortunately, does not seem to be attended with any danger. The blood that is effused at first presents normal characteristics, but with the progress of hemorrhage it becomes thin and watery; otherwise there is very little departure from the normal standard. The coagulability of the blood is somewhat reduced, and there is some variation in the constituents of the plasma, but this follows no uniform rule.

Pathological Anatomy. The *post-mortem examination* after death from hæmophilia presents little that is characteristic or instructive. A certain amount of *pallor* is apparent, and sometimes the *heart* exhibits fatty degeneration. The heart is usually small, and the *arteries* are less than usual size. Their walls are also thinner than normal. Sometimes the walls of the capillaries exhibit considerable proliferation of their cellular elements, and occasionally also, *amyloid degeneration* has been observed. It seems probable that the *essential features of the disease* consist in a reduction of the number of colorless blood corpuscles, producing a diminution of the coagulative property of the blood, together with a morbid condition of the vascular walls that favors transudation of the blood itself. But this statement of facts furnishes no explanation of the primary reduction of the number of the colorless corpuscles.

Prognosis. The prognosis of hæmophilia is always very grave. Many of the children in such families die before the tenth year, and it is seldom the case that advanced age is reached. Sometimes, however, the predisposition seems to decrease with the progress of time, so that after full growth and adult life have been reached, it may completely disappear.

TREATMENT. Prophylatic treatment consists in the attempt to regu-
te the marriage of persons, especially women, who manifest the pre-
isposition to hæmophilia. It is also desirable to avoid all exposure to
ounds and other causes of hemorrhage. The diet of such patients
ust not include articles of an exciting nature, like alcohol, tea, and
offee. When hemorrhage actually takes place, it becomes necessary to
esort to all the surgical measures that are prescribed for stanching the
ow of blood. Astringents, such as the persulphate of iron, gallic acid,
rgot, acetate of lead, etc., have been prescribed, but without much
pparent success. Saline cathartics are useful, if the bowels are con-
tipated, or if evidence of local congestion be manifested. The attempt
as been made to counteract the consequences of excessive hemorrhage
y transfusion of blood or saline solutions, but this method of treat-
ent is liable to failure, since it involves the infliction of a second
ound. The anæmia that is produced by bleeding soon disappears
fter the cessation of hemorrhage.



PART VIII.

DISEASES OF NUTRITION.

CHAPTER I.

RICKETS—RACHITIS.

ICKETS is a disease usually observed among children during the od of first dentition. It is characterized by certain deformities of bones that result from imperfect ossification.

YMPTOMS. *Rickets* occasionally develops before birth. Sometimes tendency is apparent at the time of birth, especially among children are prematurely born, or who are the offspring of juvenile and le mothers. In rare cases the manifestations of the disease are yed until the period of second dentition, but in the majority of s it is during the period between the sixth and thirty-sixth months the morbid process is most conspicuous. The earliest symptoms connected with *disorders* of the *alimentary canal.* There is diar-a, abdominal distention, nocturnal perspiration, paroxysmal fever, lerness of the bones, disinclination to assume the erect position, and at debility. (Fig. 124.) The child appears fretful, restless, and ering. In many cases the gastro-intestinal disorders are exceed-ly obstinate. Diarrhœa alternates with constipation; the perspiration the stools are unusually acid. Sometimes, however, osseous de-nities appear without any preceding dyspeptic symptoms.

Deformity of the *skeleton* usually commences with swelling of the ies of the ankles and wrists. The condyles of the femur are n invaded, and presently the anterior extremities of the ribs be-ne enlarged. The long bones of the leg and of the thigh (Fig. 5) are frequently curved outward; the spinal column becomes bent l twisted; the sternum protrudes; the thoracic wall is laterally tened, while its lower portion bulges over the abdomen; the clavicles l the scapulæ also exhibit deformity; the pelvis is flattened and con-cted; the cranial bones are flattened posteriorly; the frontal promi-ces become more conspicuous; the biparietal diameter of the cranium ncreased; the face appears small by contrast with the bulging ium, and the jaws are prominent and misshapen. These deformities, s true, may not be present in every subject. Certain portions of skeleton often escape change, but all parts are liable to suffer from disease.

The characteristic *deformity* of the *skull* is caused by the tardy closure of the fontanelle; it sometimes remains open until the third or fourth year of life. The different sutures are slowly completed, and the cranial bones become thickened along their margins. This tardy ossification permits the brain to enlarge in every direction, and the skull consequently assumes somewhat of the form that characterizes hydrocephalus. There is, however, a marked difference between the mental condition of the dull and undeveloped *hydrocephalic infant* and the lively intelligence that frequently characterizes the *rachitic child*. The effects of pressure upon the posterior part of the skull are sufficient to explain the flattening and deformity that is observed when rachitic infants are permitted to lie for a long time with the back of the head pressing upon a hard pillow.

FIG. 124.



Rachitic genu valgum. Child four years old. (SCHREIBER.)

FIG. 125



Rachitic incurvation of the bones. (SCHREIBER.)

Very characteristic are the deformities that are manifested by the *bones* of the *face*. The curve of the lower jaw approaches a right angle, and its alveolar border inclines inward in consequence of the yielding of the bone to the traction of the masseter and genio-glossus muscles. The anterior portion of the upper jaw is rendered prominent by the pressure of the tongue during the action of suction. The superior maxillary bones are compressed so that the arch of the hard palate is narrowed and elevated. These facial deformities, of course, may be entirely absent in many cases, or present in a minor degree only.

The process of *dentition* is greatly retarded. When the incisors appear later than the ninth month the existence of rickets may be suspected. The teeth are frequently thick and square; the enamel is not evenly distributed, and appears as if eroded at different points

n the surface; these erosions assume various forms. When the nd set of teeth appear, their incisive margins are frequently ıated, and they rapidly decay and crumble away.

When the *spinal column* is invaded by the disease there is an eased convexity of the dorsal curve in the thoracic region (kypho- , and there is lateral curvature with the convexity towards the right liosis). The compensatory curvature in the opposite direction is eloped in the cervical and lumbar portions of the spine. At the ıe time the vertebral column is twisted around its axis in such a that the bodies of the vertebræ are directed toward the lateral vexity. The angles of the ribs upon the side of the convexity ome therefore more prominent posteriorly, while upon the opposite e of the thorax the ribs are flattened. The most prominent portion he back is consequently beneath and below the right shoulder-blade. on the anterior portion of the thorax there is a compensatory prom- nce of the ribs upon the left side, while they are depressed upon the ht side of the sternum. In many cases these deformities do not ear, and the principal evidence of disease involving the thoracic uctures is furnished by an enlargement of the anterior extremities of ribs. In many cases, however, the lateral walls of the thorax are npressed, and the sternum, arching strongly forward at its middle tion, is shortened and flattened like the breastbone of a bird; hence term *pigeon-breasted* that is applied to such children. At the ıe time the base of the thorax is frequently expanded, through the argement of the liver and the distention of the stomach and intestines. The *scapulæ* and the *clavicles* are frequently thickened and deformed a manner that corresponds with the deviations of the thoracic wall. e *pelvis* undergoes various modifications, by reason of the weight of superincumbent trunk and the upward thrust of the femoral bones n which it is supported in the standing position. The antero-pos- or diameter of the superior strait is shortened; the oblique diameters usually diminished; the transverse diameter undergoes less altera- ı, and the inferior strait usually escapes deformity. The anterior erior spinous processes of the iliac bones are pressed outward; the cavity of the sacrum is diminished or completely obliterated, and angle of the pubic arch is considerably increased. In many cases pelvis is symmetrically deformed by the crowding inward of the rum and the cotyloid cavities toward the central point of the supe- strait. In other cases the pelvis is laterally flattened, and its ver- l axis deviates correspondingly from the perpendicular, as if the tic bones had yielded to a weight that bore chiefly upon one side of framework. This constitutes the *scoliotic* form and variety of ic deformity.

Rachitic deformity of the *cranium* produces less injury of the cere- l functions than might have been anticipated. In many instances degree of intelligence is fully equal to that of other children. The rmities of the thorax, however, exercise an unfavorable influence n the functions of the heart and lungs. The *heart* may be dis- ed, and its movements are often rendered unusually conspicuous its close application to the thoracic wall. Sometimes the organ

becomes hypertrophied by reason of the hindrance to its movements occasioned by the deformity and displacement of the adjacent ribs. The *lungs* are similarly confined and restricted in their movements, so that they cannot attain to their normal size. Emphysema is consequently often developed, and all broncho-pulmonary diseases are attended with extraordinary danger; the difficulty with which blood finds its way through the pulmonary vessels reacts upon the right side of the heart and produces its dilatation. The vesicular murmur is diminished in those portions of the lungs that are compressed in the neighborhood of the spinal column, while the opposite portion of the thorax is very resonant, and the respiratory sounds assume a puerile character.

Pelvic deformities acquire great importance through the obstacle which they present to the act of parturition.

In cases that are characterized by excessive *deformity* of the *limbs*, locomotion may be seriously hindered. The knees sometimes interfere by reason of the extreme incurvation of the long bones of the lower extremities (genu valgum); but moderate curvature of the long bones does not seriously interfere with the movements of the patient.

The *fragility* of the bones that is occasioned by rickets leads to the frequent occurrence of *fracture*. This is often partial, involving only the sub-periosteal portions of the bone. These fractures may be produced by simple muscular contractions, or by other trifling causes. Reunion is sometimes imperfectly accomplished, and a false joint may result at the point of injury.

A tendency to *laryngeal spasm* is sometimes apparent in the subjects of rickets, but it is not peculiar to the disease.

Pathological Anatomy. The *lesions of rickets* are principally manifested in the bony skeleton, and are dependent upon an insufficient supply and inferior quality of the elements that are needed for the proper development of the bones. During the period of healthy development and growth, the hyaline cartilage of the epiphysis is separated from the fully developed bone by a thin layer of tissue composed of cartilage cells which by their multiplication form the framework for the growth of osteoblasts, that are finally transformed into perfect osteoplastic cells infiltrated with calcareous salts.

In a *rickety bone* the space that intervenes between the epiphysis and the medullary cavity consists of, and is occupied by, four distinct layers of tissue. Of these, the first is a layer of hyaline cartilage; next to this lies a thick stratum of cartilage in a state of active proliferation; the surface of this layer that lies nearest to the bone is rendered very irregular by the protrusion of numerous processes in the direction of the ossified tissue; these processes lie in a third layer of spongy substance which is reddened and softened, as if the shaft of the bone had been soaked in an acid fluid; this appearance is caused by a disturbance of the nutritive processes connected with ossification. Sometimes this spongy layer occupies nearly all the space between the epiphysis and the diaphysis of the bone; it closely resembles in appearance the skeleton of a delicate sponge; its alveolar spaces contain a thin medullary substance of a red color, containing numerous blood corpus-

and round cells that are sometimes loaded with pigment; the partions between these cavities resemble imperfectly formed osseous substance, and are usually described as consisting of morbid cartilaginous structures, more or less infiltrated with calcareous matter.

The portion nearest to the diaphysis consists of ossified tissues that have undergone more or less alteration, of which the extent and severity is dependent upon the degree of development which had been reached by the ossifying tissues in the neighborhood of the diaphysis, before their invasion by the rickety process.

The *sub-periosteal tissue* along the shaft of the bone manifests similar disturbances of the process of ossification. These tissues are soft, thickened, and more vascular than in the normal condition. The maximum of swelling is reached about the middle of the shaft of the bone. The periosteum appears loosened, and so copious is the morbid supply of blood that the sub-periosteal substance might be easily mistaken for an inflammatory exudation. The swelling and thickening of the morbid structures is so great that the medullary canal of the bone itself may be constricted by the encroachment upon its cavity that is thus effected. As the disease progresses this morbid tissue becomes condensed and serves as a bond of union between the periosteum and the subjacent bone. It also forms the substance of the callus that connects the fragments of rickety bones that have undergone fracture.

Within the *medullary canal* of the shaft of the bone the process of ossification is perverted, as it is elsewhere. The diseased bone becomes excessively vascular; the calcareous salts are dissolved and removed, so that in well-marked cases less than one-third of the normal quantity remains in the tissues; and the osseous structure becomes transformed into a spongy mass in which may be distinguished the remnants of ossified matter which give only an imperfect degree of solidity to the morbid tissue. As a consequence, the bone is incapable of supporting the weight of the body, and is either fractured by the sudden application of moderate force, or is gradually bent and twisted by the prolonged action of unequally antagonistic groups of muscles. Similar morbid processes effect the changes that are observed in the flat bones of the body.

The arrest of the morbid process in a rickety bone may be followed by the deposit of solid matter in the diseased tissue. An ivory-like hardness is produced by this infiltration; the bone becomes solidified and condensed to a degree that interferes with its nutrition and further growth. In this way premature ossification of the cranial sutures may occur, permanently limiting the capacity of the cranium. Long bones may be in like manner prevented from reaching their full growth.

Fortunately, however, in the majority of cases, the process of recovery is usually effected by gradual absorption of the spongy substance that has been the seat of disease. The normal course of ossification is resumed, and recovery may be thus completely effected, though, in many instances, an irregular outline and uneven surface remain as permanent indications of former disease.

When a rickety bone is fractured, displacement of the fragments is usually prevented by the thickened periosteum; such fractures are fre-

quently partial in their character, like those which may be produced within the bark of a green stick, that is bent at an acute angle, without actual rupture of its fibres.

ETIOLOGY. The actual nature of the causes that determine the errors of nutrition by which the phenomena of rickets are produced remains hidden in the arcana of molecular chemistry. It is possible at present to indicate only the predisposing causes of the disease.

The fact that rickety processes are usually manifested during the first three years of life is dependent not so much upon the particular *influence of age* as upon the character of the diet that is supplied to the patient during that period. Children who are properly nourished do not manifest the disease.

Hereditary influences appear to operate in a similarly indirect manner. Rickety patients beget rickety offspring, not because the disease is transmissible, but because the children of enfeebled parents are peculiarly liable to errors of nutrition and to faulty alimentation before and after birth. In like manner scrofulous, tubercular, and syphilitic parents may have rickety children, not because rickets is an hereditary legacy from those diseases, but by reason of the unfavorable conditions of nutrition which attend the ante-natal development and subsequent growth of such offspring.

The *influence* of *climate* upon the manifestation of rickets is well marked. The disease exists in cold northern countries, and is rarely observed in tropical climates; it seldom occurs at any considerable elevation above the level of the ocean, but it is commonly witnessed among the inhabitants of cold, damp, and low-lying territories. It is among the impoverished inhabitants of such unwholesome regions that the disease is most frequently experienced.

A fruitful source of the defective nutrition that fosters the development of rickets exists in the *inability of mothers to nurse their children*. This defect, though natural enough among the impoverished victims of hereditary disease and hygienic neglect, is not unfrequent among the members of the upper classes in society. The mode of education and the social customs that prevail in modern civilization are extremely prejudicial to the function of lactation. Comparatively few of the women who have been born and brought up in the whirlpool of city life are capable of nursing their children; if they succeed with the first, a perceptible reduction of capacity is observed with each successive child, and frequently it is impossible for the later-born children to obtain anything like adequate nourishment from the maternal breast. Under such circumstances, since in the majority of families a healthy wet-nurse cannot be procured, artificial substitutes for the mother's milk are employed, too often without adequate knowledge of the precautions that are necessary to prevent the immediate effects of unhealthy food. The artificial substitutes for mother's milk with which the market abounds contain starchy elements that are unfitted for the proper nutrition of the nursling child. Gastro-intestinal catarrh soon appears, and if life be not quickly terminated by inflammation of the alimentary canal, the train of morbid processes that terminates in rickets is speedily established. Very few are the bottle-fed children

do not sooner or later manifest some of the symptoms that indi- disturbances of the process of ossification in some portion of the y skeleton.

The *dyspeptic disturbances* above noted tend to disturb the normal tions of the digestive fluids within the alimentary canal. The gas- juice becomes impoverished, and the normal alkalinity of the in- inal contents is reduced. Lactic acid and other organic acids appear excessive amount. It has been shown that these acids interfere h the assimilation of the phosphate of calcium. When lactic acid is sent in excess the earthy phosphates disappear from the tissues and augmented in the urine. It is a fact of daily observation that the spiration, feces, and other excrements of rickety patients manifest inordinate degree of acidity; this acid dyscrasia is most intimately ociated with the failure of calcification in rickety bones. It is pos- le, moreover, that the luxuriant proliferation that is manifested by cartilaginous and spongy tissues which are the seat of disease is due the removal of that calcareous framework by which, under normal ditions, the inordinate cellular growth would have been moderated.

DIAGNOSIS. Well-pronounced forms of rickets can be easily recog- ed; only the incipient and moderate forms present any difficulty. egular and tardy appearance of the teeth, copious perspiration from scalp, chronic diarrhœa, and nervous irritability are indications of ickety tendency. *Chronic hydrocephalus* produces a deformity of skull that resembles the rickety form, but it is usually accompanied convulsions and idiocy. *Osteomalacia* is rarely observed among ildren. *Congenital syphilis* sometimes causes deformity of the iphyses at the very commencement of life, but it is associated with aracteristic eruptions upon the skin and mucous membranes.

PROGNOSIS. The prognosis in rickets is not very unfavorable if her complications be not associated with the disease, and if whole- me food can be procured for the patient. Osseous deformity some- nes undergoes spontaneous improvement, but usually the consequences severe rickets remain permanently impressed upon the skeleton. In ter life pelvic deformities may occasion great difficulty and danger in e act of parturition. When the spinal column and the thoracic wall e considerably misshapen a predisposition to intra-thoracic diseases is us established.

TREATMENT. The prophylactic treatment of rickets requires atten- on to the health of the pregnant mother. Juvenile marriages should so be discouraged. The infant after birth should be nursed for at ast eight months; and if the mother's milk is insufficient or unwhole- me, a healthy wet-nurse should be secured, if possible. All digestive orders should be noted and treated at the earliest possible period. e period of lactation must not be too greatly prolonged, since the ther's milk, under such circumstances, becomes impoverished in lity, and does not supply a sufficient amount of calcareous salts for proper nutriment of the bones.

Rickety children usually exhibit inordinate distention of the abdo- n; this is caused by dilatation of the stomach, and by excessive ulence in the intestines, consequent upon indigestion. If the diet

contain too much sugar and starch, these substances are decomposed, and lactic acid is liberated in excess. The acid contents of the alimentary canal transferred to the blood hinder the proper assimilation of phosphates, and thus serve to initiate the rickety process in the bones. For this reason children should be nursed at regular intervals, and the milk must be neither excessive nor deficient in quantity, neither too rich nor too thin. Acidity should be prevented by the addition of soda or lime-water.

At the time of weaning it is necessary to continue the use of food that is principally digested in the stomach, since food that is digested in the intestines parts with its calcareous salts, and they are precipitated and voided with the stools. For this reason the diet should consist of milk, soft boiled eggs, meat-juice, and thoroughly cooked oatmeal gruel; at a later period, fish, broths, bean soup, and preparations of whole meal, all of which are rich in phosphates, may be added; cod-liver oil is also useful at this period, if it can be properly digested.

In the treatment of rickets salt baths, friction of the skin, gentle massage, and an outdoor life, are all of great importance.

The *pharmaceutical treatment* of rickets consists in the administration of phosphorus, of which one-sixth of a grain may be dissolved in three ounces of cod-liver oil; of this mixture fifteen drops may be given three times a day. A more agreeable preparation is the following:

R.—Phosphorus. gr. ¼.
Ol. amygdal. dulc. ʒ ijss.
Pulv. gum acaciæ, }
Syr. simpl. } āā ʒ jss.
Aq. destill. q. s. ad ℥ iij.—M.

S.—Give one to four teaspoonfuls in divided doses, each day, according to the age of the patient.

The syrup of iodide of iron, and small doses of nux vomica or of gentian, have been recommended. The salts of calcium are also useful in many cases; it is generally sufficient to sprinkle a small quantity of powdered calcium phosphate upon the food of the patient. An emulsion of the lacto-phosphate of calcium with cod-liver oil frequently gives a good result. The syrup of the lacto-phosphate of calcium should be generally avoided, since the continual administration of syrups tends to aggravate the acidity of the alimentary canal. For the same reason the syrup of the hypophosphite of calcium is objectionable, but the powdered salt itself may be given with advantage in a freshly prepared aqueous solution.

CHAPTER II.

OSTEOMALACIA.

Osteomalacia is a disease that is characterized by decalcification and softening of the bones. It is a malady of adult life and old age, in this respect differing from *rickets*, which is manifested only during early life

n interference with the formative processes by which the skeleton volved. Osteomalacia attacks and destroys bones that have been y developed and far advanced in age.

YMPTOMS. *Osteomalacia* commences insidiously, with vague pains, ecially in the region of the vertebral column and pelvis. These ns are usually referred to rheumatism or neuralgia, but careful mination is unsuccessful in localizing them upon the muscular or -articular tissues of the body. The pain is dull and continuous, and augmented by long-continued standing or sitting without change of ition. These pains are not excited by pressure, yet pressure is ally painful when applied to the seat of suffering. They are gener- augmented by the warmth of the bed at night. After a time ormity becomes manifest at the seat of pain. When the disease urs during pregnancy, pain is experienced in the pelvis, and is ravated by walking, standing, or sitting. In advanced cases the montory of the sacrum is pushed forward, and the lateral portions the pelvic cavity approach each other so that the symphysis pubis jects strongly in front. The act of parturition is of course rendered icult, if not impossible, by these deformities.

Among old people the disease is usually manifested in the spinal umn and in the thoracic walls. The stature of the patient progres- ely diminishes; the spine becomes bent either antero-posteriorly or erally. As the natural curvatures become exaggerated, curves of mpensation are developed in other portions of the vertebral column. e sternum projects forward; the shoulders become unequal; the head ds forward so that the chin approaches the breastbone; the bones the extremities and the shoulder-blades may also share in the process disease. The distal phalanges of the fingers and toes sometimes come thickened and enlarged; the cranial bones rarely suffer, except the severest cases of puerperal osteomalacia.

As the disease advances the *bones* are frequently *fractured* by the ghtest cause, and their repair is exceedingly tedious and imperfect.

It is obvious that as the disease develops the act of *locomotion* becomes reasingly difficult; the movements of the *heart* and of the *lungs* are o impeded as the thoracic cavity undergoes deformation.

Digestive disorders are frequently observed, and are supposed to rt a prejudicial influence in the causation of the disease. Dilatation he stomach and excessive acidity of the alimentary canal are com- n occurrences. Chronic diarrhœa, chronic bronchitis, and chronic hritis, sometimes occur.

The *duration* of the disease is variable, sometimes terminating life in w months, though generally its course is prolonged for a number of rs. When the disease commences during pregnancy it is liable to ewed aggravation during subsequent periods of pregnancy. *Death* ults from marasmus, or from intercurrent diseases, such as pneu- nia, tubercular consumption, bedsores, etc.

ETIOLOGY. The occurrence of *pregnancy* is the most powerful pre- posing cause of osteomalacia; *old age* occupies the second place.

The occurrence of osteomalacia during pregnancy must be explained the existence of an error of nutrition which derives the calcareous

salts and other materials needed for the development of the fœtal skeleton from the osseous tissues of the mother. Nearly 90 per cent. of the recorded cases of osteomalacia have consequently occurred among women; of these female patients, 75 per cent. had been pregnant, and in 50 per cent. the disease commenced during pregnancy. *Prolonged lactation and frequent childbearing* are also favoring causes for the development of the disease.

It is supposed that the use of drinking-water that contains an insufficient amount of calcareous salts may favor the development of osteomalacia, especially among patients whose hygienic environment is defective.

As might be expected, a parasitic explanation for the occurrence of the disease has been conjectured, but for this there is no adequate proof.

Pathological Anatomy. The changes manifested in the bones during the course of osteomalacia consist simply in the solution and removal of calcareous salts from the osseous framework. The cellular elements do not multiply, and the fundamental substance (osseine) of the bone assumes a fibrillary appearance. It apparently undergoes hyaline degeneration, and does not yield gelatin when it is boiled. The marrow, however, is at first highly vascular and reddened, and its cells are considerably multiplied. At a later period the tissue becomes infiltrated with fat.

The diseased bones contain an excess of lactic acid, which also appears in the urine. The normal alkalinity of the blood is also considerably diminished. The percentage of the mineral constituents of the bones may be diminished from 54 to 20 per cent.

The *urine* does not often contain an excessive amount of calcareous matter. Earthy calculi are sometimes found in the kidneys and in the bladder, but a large proportion of the phosphates is removed with the milk of the nursing mother, or find its way to the tissues of the embryo in cases of pregnancy.

The *decalcification* which thus occurs is dependent upon the excessive presence of lactic acid in the bones; it is uncertain whether this acid is produced in the substance of the bone itself, or whether it is merely accumulated there after its formation elsewhere. Such accumulations may be very easily occasioned by defective oxidation within the tissues. This acid dyscrasia interferes with healthy nutrition and leads to the solution and removal of earthy phosphates from the bones. This explanation is rendered still more probable by the fact that lactic acid, and other organic acids, are present in excessive amount in diabetes, and it appears that osteomalacia may be exchanged for diabetes in the same person, if subjected to a change of environment from the damp and squalid conditions that favor osteomalacia. Under such circumstances the osseous disease is arrested before glycosuria appears as a consequence of the persistence of the acid dyscrasia. It is probable, moreover, that the osseous pains which are so frequently experienced by the victims of pulmonary consumption, and are accompanied by phosphaturia, are in like manner dependent upon a minor degree of osteomalacia that is insufficient to produce softening and deformity of

bones. In the same way the occurrence of abnormal fragility of bones may be explained. It is a matter of observation that in all se cases, not only are the calcareous salts reduced in quantity, but nitrogenous and fatty constituents of the skeleton are also greatly inished, and are replaced by an increased amount of water.

PROGNOSIS. The prognosis is exceedingly unfavorable. Recovery very rare incident, though life may be prolonged for a considerable nber of years.

TREATMENT. The treatment of osteomalacia is principally addressed the improvement of the digestive functions. The food should be ndant and digestible, consisting largely of eggs, milk, and whole al flour. The circulation should be improved by friction of the skin, ssage, salt baths, and gentle exercise. These methods will accomsh better results than can be obtained from cod-liver oil, phosphorus, l the ordinary tonics. The occurence of the disease during pregncy may render necessary the operation of Cæsarean section. Retly the ovaries have been removed with favorable results in the way preventing pregnancy, and arresting the progress of the disease in es where it was already manifested. In certain cases the suppresn of the menses that follows the operation appears to exert a most orable influence.

CHAPTER III.

OBESITY—POLYSARCIA.

OBESITY is a condition of ill health characterized by an excessive cumulation of fat in the adipose tissue of the body, by which the action of the various organs is hindered, and finally rendered imssible. This accumulation of fat is seldom distributed uniformly roughout the body; sometimes it is excessive in one portion, and netimes in another; it may greatly hinder the functions of a parular organ, while others experience very little impediment. The ceral cavities rarely become overloaded with adipose tissue without similar enlargement of the subcutaneous deposit, so that external pulence may be generally accepted as sufficient evidence of an inal burden.

Among the internal organs that suffer from obesity the *heart* is the st important. Fat is deposited under the visceral pericardium, in furrow between the ventricles, and around the roots of the large sels. In an advanced stage of the disease the muscular fibres of left ventricle are forced asunder by the fat that infiltrates the contive tissue. Pressure thus produced causes atrophy and fatty deeration of the muscular substance. In this way the functions of heart are rendered difficult, both by the external burden of fat and the degeneration of the contractile tissue of the organ itself. In

like manner the *liver* is frequently overwhelmed; it suffers from the external pressure of the fat-laden epiploön and mesentery before the hepatic cells become infiltrated and finally incapable of function.

In the normal condition the fat cells of the *adipose tissue* receive and store up a certain amount of fat that serves as a magazine from which is continually supplied the proper quantity of fatty matter that is needed for the healthy nutrition of the tissues; in this respect the function of the adipose tissue is quite analogous to that of the glycogenous tissue of the liver. This adipose tissue is encountered wherever there is connective tissue, excepting in the lungs, in the liver, spleen, kidneys, and encephalic organs. The physiological amount of adipose tissue is about one-twentieth of the total weight of the body.

The supply of fat in the adipose tissue is normally recruited in part from the *alimentary fat* which enters the circulation, either in the form of an emulsion or in the form of glycero-phosphoric acid and soap. A portion of the fat is held in solution by the aid of the soaps that are formed by the union of the fatty acids with alkaline bases. The decomposition of fat into glycerin and fatty acids is effected by the action of the pancreatic juice and the bile. As glycerin is liberated, it enters into combination with phosphoric acid that has been displaced from the alimentary phosphates by the hydrochloric acid of the gastric juice. The resultant glycero-phosphoric acid and the soaps that are formed by the fatty acids are highly diffusible, and pass readily into the general circulation. The emulsified fats arrive at the same destination through the chyliferous passages and the thoracic duct. Conveyed to the tissues the glycerin and fatty acids are rapidly oxidized, while the more stable emulsified fats are stored up in the cells of the adipose tissue.

Besides the source of supply that exists in the alimentary fats, a certain amount of *fat is formed during the retrograde metamorphosis of the albuminoid constituents of the tissues.* During this process albumin splits up into nitrogenous bodies like leucin, tyrosin, and other antecedents of urea, while the remainder contains no nitrogen and yields substances identical with fat and other compounds of carbon and hydrogen. In this way an animal that is fed upon albuminoid substances alone may still grow fat.

When fat enters the blood in quantity greater than can be held in solution by the soaps and alkaline salts a portion remains suspended in the circulatory fluid, presenting and giving to the blood an oily appearance, constituting what is termed *lipæmia.* When the process of oxidation proceeds at the normal rate, the fats that are thus introduced are rapidly oxidized; when introduced in excessive amount the oxygen that is active within the tissues cannot completely effect their oxidation, and the surplus fat accumulates in the adipose tissue and in the cells of the liver. When the processes of oxidation are exaggerated by violent exercise or by fever, fat ceases to accumulate, and rapidly diminishes in amount. For this reason the excessive disappearance of fat is accompanied by a diminution of the staying power of the individual; hence the lack of endurance that characterizes athletes, gymnasts, and champions who have been deprived of their

served force by overtraining that has caused the dissipation of their lipose tissue.

PATHOLOGICAL ANATOMY. The *adipose tissue* accumulates chiefly pon the anterior and lateral portions of the abdomen, about the loins, ips, breasts, neck, cheeks, and under the chin; it is found in the exures of the joints, upon the palms of the hands and the soles of he feet; it is also abundant beneath the aponeuroses, between the uscles, even insinuating itself among their constituent fibres. It is ometimes difficult to reach internal organs, like the kidneys and the ancreas, which are completely buried in a mass of tallow. The *tomach* and the *intestines* are usually dilated; the *liver* is enlarged, s borders are rounded, its color is pale, and oil oozes from incisions nto its mass. The degree of fatty infiltration is, however, less than hat exists in certain diseases that are attended by fatty degeneration f the organ. The hepatic cells are overladen with fat, but they are ot in a condition of degeneration, and there is no accumulation of fat n the connective tissue outside of the hepatic cells. The *secretion of ile* is greatly hindered, so that the gall-bladder and the larger bile ucts are often empty or filled with mucus.

When obesity is complicated with *alcoholism* or other diseases that nvade the *liver* the hepatic cells undergo fatty degeneration (steatosis): nder these conditions the connective tissue exhibits a certain amount f sclerotic change; the liver is then less soft and unctuous, and the utlines of the sclerotic meshwork can be traced among the groups of egenerated parenchymatous cells. If *death* has been occasioned by ardiac failure, the hepatic veins are distended with blood, and the liver resents the appearances that are characteristic of a stagnant circulation nutmeg liver).

The *kidneys* frequently escape without notable change. If death has een preceded by progressive asphyxia, their veins are distended with lood. In severe cases, especially when dependent upon alcoholism, he epithelium of the uriniferous tubules is frequently infiltrated with inute particles of fat.

The connective tissue of the *pancreas* is more or less infiltrated with at. The *spleen* exhibits little alteration.

In female patients the *uterus* and its accessory structures are tightly acked into the pelvis, and fixed by layers of overlying fat. The *ammary glands* also become atrophied, in consequence of the enor- ous accumulation by which they are compressed.

The great distention of the abdominal cavity crowds the *diaphragm* pward. The great increase of fat in the mediastinal spaces, and be- eath the pericardium and pleural membranes, diminishes the thoracic avities, and hinders the proper expansion of the *lungs*. These organs re frequently in a condition of emphysema, and are engorged with ood when death has been preceded by symptoms of asphyxia and rdiac failure.

The right ventricle of the *heart* is always more fatty than the left. he organ is burdened with masses of adipose tissue, and the myocar- um is anæmic, pale, degenerated, and softened; sometimes there is niversal dilatation of the cavities of the organ; sometimes the left

ventricle is hypertrophied, while the right heart is dilated; sometimes there is general atrophy. At an early stage of the disease the heart may be simply overburdened with fat, but as the disease progresses the spaces between the muscular fibres become infiltrated, and finally the muscular substance itself undergoes fatty degeneration.

The *blood* presents an oily appearance; as a consequence of the presence of minute particles of undissolved oil, the amount of fatty matter may be four or five times greater than in the normal condition. In the state of health the blood contains between one and two parts of fatty matter per thousand; but in obesity these substances may be present to the amount of between five and six parts per thousand.

SYMPTOMS. *Obesity* occurs more frequently among women than among men. It sometimes exists among infants and young children; in certain instances children less than five years of age weigh as much as men of ordinary size; a case is recorded of a child who at ten years weighed 200 pounds. Among adults a weight of 200 to 220 pounds indicates for a person of medium height the first degree of obesity. A weight of 300 or 350 pounds constitutes the medium form of obesity. When the weight rises to a figure between 400 or 500 pounds, the disease must be considered serious. There is recorded the case of a man who measured fifteen feet in circumference, and weighed 715 pounds; and of one monster it is related that his weight lacked only twenty pounds of eleven hundred.

The *distribution of fat* depends largely upon the habits of life and the sex of the individual. Women accumulate adipose tissue in excess about the shoulders and breasts. Sedentary people and great eaters exhibit enormous abdominal enlargement. In aggravated cases of the disease locomotion becomes difficult; the various acts of life are rendered impossible without assistance, and finally the unfortunate victim is compelled to remain in bed, supported by pillows and cushions, since it is impossible to lie down on account of the difficulty of respiration.

Sexual appetite rapidly diminishes and becomes finally extinct. When obesity occurs among young girls, menstruation is usually precocious; it is often irregular; amenorrhœa and menorrhagia sometimes occur, and sterility is exceedingly common.

Muscular power is greatly diminished, though sometimes special skill and dexterity have been cultivated by professional people—like musicians, artists, and gymnasts. Occasionally considerable intellectual power is manifested by very corpulent people, but generally the intellectual faculties are greatly impeded in their action. The victims of obesity sleep much, especially after eating.

The occurrence of obesity interferes seriously with the movements of *respiration* and with the action of the *heart*. Such persons are quickly out of breath after any muscular exercise. This is due to the limited capacity of the thoracic cavity, and in certain cases it is aggravated by the diminution of hæmoglobin in the red corpuscles. The number of these bodies is not diminished, but their capacity for oxygen is greatly decreased, hence the want of breath that is experienced by the patients.

In about one-third of the cases the *pulse* is retarded; in another third the pulse is feeble, frequent, and dicrotic. The heart is also

feebled, and there is complaint of palpitation and dyspnœa upon the ightest effort. In about one-quarter of the cases among elderly sub- cts symptoms of arterio-sclerosis are apparent. The pulse is full and ypertrophied; vertigo, dyspnœa, and asthma are not uncommon. In small number of cases the pulse is feeble, frequent, intermittent, and regular, and dyspnœa is almost intolerable.

Various forms of *hemorrhage*, such as epistaxis, hæmoptysis, and leeding piles, are not uncommon among the obese. These are depend- nt in great measure upon fatty infiltration of the vascular walls.

Two forms of obesity are readily distinguished. The first is char- cterized by *plethora;* the face is red, the lips are blue, and upon the heeks and nose the veinlets are distended with blood. The *anæmic* orm is characterized by pallor, by murmurs in the large vessels, and y a tendency to syncope. In certain cases of *combined obesity* and *hlorosis* there is a congenital lack of development in the vascular sys- em, so that the heart, lungs, liver, and arteries are insufficient for the istribution of blood to the relatively enormous body. In such cases he total amount of blood is less than normal, though its quality may onform to the proper standard.

The process of oxidation in the tissues is depressed, and consequently he amount of *carbonic acid* that is discharged from the lungs is dimin- shed, and the *temperature* of the body is reduced.

In the majority of cases the amount of *urea* is below the normal uantity. The *phosphates* are also diminished, but in certain cases he amount of urea remains normal, and sometimes it is increased.

When the excessive accumulation of fat is due to the splitting up of lbuminous substances, in connection with a deficient supply of oxygen, portion of the nitrogenous refuse appears in the *urine* in the form of modified albumin that is not dependent upon an inflammation of the idneys, but rather upon the disordered condition of nutrition. Some- mes, minute globules of oil make their appearance in the urine, and is not uncommon to discover sugar in the urine. In certain cases is is due to the coexistence of diabetes, but sometimes it is dependent pon a disordered condition of the liver that hinders the transformation the starch and sugar of the food into glycogen. In such cases the imentary sugar passes directly into the circulation and is eliminated ith the urine.

Oxalate of calcium is very frequently present in the urine of obesity, cause the reduction of oxidation renders it impossible to destroy the talic acid that enters, or is formed in, the tissues. For the same ason the volatile acids are not oxidized, and their elimination through e skin causes irritation of the sebaceous glands and of the integu- nt. Acne, eczema, intertrigo, and seborrhœa frequently occur. e perspiration is also copious, and is characterized by a disagreeable or.

The *appetite* is sometimes excessive, and obese patients have been own to consume enormous quantities of food and drink. Sometimes *yuria* exists at the same time. In the majority of cases digestion lly gives way, the stomach becomes dilated, and the symptoms of l dyspepsia (pyrosis, flatulence, acid eructations, and constipation)

are manifested. Sometimes there is diarrhœa, and the feces may contain a large quantity of fat.

Such excessive appetite, however, exists in less than half the cases. In about fifty per cent. of the patients the appetite is normal, and in about ten per cent. the daily quantity of food that is consumed is less than usual.

Obesity is frequently accompanied by *stagnation of the blood* in the intestinal vessels. The muscular coat of the intestines becomes enfeebled, there is obstinate constipation, and hæmorrhoids are developed. Varicocele and varicose enlargement of the veins in the lower limbs frequently occur. Similar laxity of the other non-striated muscular tissues of the body is very commonly observed whenever these dilatations of the veins exist.

ETIOLOGY. *Excess in eating and drinking* has been noted by Bouchard in about forty per cent. of the cases of obesity; in about thirty-seven per cent. there was a deficiency of exercise, but in twenty-eight per cent. more than ordinary exercise was taken; and in ten per cent. the amount of food was below the normal quantity. The disease occurs rather more than twice as frequently among women than among men.

The influence of *heredity* is quite remarkable. Nearly one-half of the cases occurred in the direct line of descent from corpulent ancestors. It is worthy of note that those hereditary influences which predispose to *arthritic disease* also favor the occurrence of obesity. In fact, the arthritic diathesis is characterized by a retardation of the molecular changes that are concerned in the processes of nutrition, so that its victims are predisposed to rheumatism, gout, gravel, biliary lithiasis, diabetes, asthma, acid dyspepsia, hæmorrhoids, hemicrania, neuralgia, and eczema, a group of diseases that apparently depend upon a common cause. These diseases are frequently associated in the same subject, either at the same time or alternately, and their association may be traced through many successive generations. In like manner those forms of *scrofula* that are not associated with tuberculosis frequently manifest a tendency to the development of arthritic diseases.

Obesity may be manifested at any time in the course of life. It is sometimes congenital; in other cases it does not appear before the age of puberty; and it may be delayed until the decline of life.

The development of the disease is much more frequently occasioned by the *excessive use of starchy and saccharine food* than by the ingestion of oily substances. *Acid dyspepsia* is another common cause of obesity; excessive acidity of the contents of the small intestine hinders the action of the pancreatic juice, and the fats are consequently absorbed in the form of an emulsion instead of being decomposed into glycerin and fatty acids. These emulsified fats largely escape oxidation, and are stored up in the adipose tissue. Sedentary habits and lack of exercise prevent the assimilation of sufficient oxygen, and therefore favor the accumulation of unoxidized fats in the tissues, thus contributing to the development of obesity. In like manner the continued use of alcohol, even in small quantities, hinders the process of oxidation and favors the accumulation of fat. For these reasons people who live in the open

ithout taking much exercise, and who consequently have excellent tites which they indulge freely, present some of the finest examples esity. Among these, stands preëminent the old-time coachman, e life alternated between a state of immovability upon his coach- and a condition of equal inertia upon the oaken settle of a bar-, behind a table covered with appetizing viands that were washed with copious draughts of strong ale and porter. These drinks, les alcohol, contain dextrine and sugar, substances that are ad- bly calculated to promote the development of adipose tissue.

mall and frequent *losses of blood* favor the development of obesity anæmia. For this reason many women manifest the disease in ter or less degree. The impoverished blood becomes incapable of sporting a sufficient amount of oxygen; the process of oxidation is equently retarded; and obesity accompanies the establishment of mia. In like manner *pregnancy*, *disturbances of menstruation*, *lactation*, frequently occasion the disease. This is especially true the patient leads a sedentary life and indulges an appetite for holic beverages and sweets.

he period of *convalescence after various infective diseases* is some- s marked by a tendency to obesity. This is probably due to the urrence of conditions that have been already noted. In many s, doubtless, nutrition is profoundly influenced by the secretions of nfective micröorganisms by which the tissues have been invaded. ng these perversions of nutrition obesity finds its place.

mong the predisposing causes of obesity, a retardation of the pro- es by which fats are oxidized in the tissues has been made promi- . In addition to this must be mentioned the fact that the disease is unfrequently occasioned by the operation of causes that favor the luction of fat within the tissues. This may depend either upon a *ndancy of oily substances in the food*, or upon the *direct pro- ion of fat* through the splitting up of albuminoid molecules. It been incontestably demonstrated that fat can be accumulated from t composed entirely of lean meat. It has also been shown that a of starch and sugar favors the development of fat, provided a cer- amount of albuminoid matter be also supplied to the tissues. er such circumstances the carbohydrates are oxidized, while the minoids are split up into fat and into simpler nitrogenous com- ds by which the integrity of the tissues is maintained, and the se tissue is increased. For this reason a diet of potatoes, bread, orn-meal, favors the accumulation of fat, since those substances ain not only starch but also albuminous constituents.

he influence of *water* upon the development of fat has been exten- y discussed, and a considerable variety of opinions has been essed. In the opinion of certain physiologists the copious use of r does not contribute to the development of fat, while others main- the opposite doctrine. It appears to be probable that water alone ithout special influence, but when it is diluted with alcohol, and it is reinforced with sugar and dextrine, it may contribute largely e growth of corpulence.

many cases *disorders of the nervous system* appear to favor the

development of obesity. Hysterical patients not unfrequently exhibit considerable excess of adipose tissue. The influence of neuralgia in the production of local accumulations of subcutaneous fat has been frequently cited. The corpulence that is sometimes noted after a paralytic stroke may be probably explained by the enforced change of habits from an active life to a sedentary mode of existence.

TREATMENT. From time immemorial the importance of moderate diet and abundant exercise have been recognized. By the exclusion of fats and starch from the food, and by a large reduction of the amount of liquid that is permitted, the bodily weight can be rapidly diminished; but with a diet thus restricted a tendency to lithiasis is very frequently manifested, and the patient suffers from hepatic or renal colic. This is one of the chief defects of the Banting method for the cure of obesity. Ebstein recommends three meals a day, of which *breakfast* is limited to one cup of black tea, without milk or sugar, and two ounces of well-buttered toast; *dinner* in the middle of the day, consisting of shin-bone soup and four to six ounces of fat meat well boiled or roasted and served with gravy; peas, beans, and cabbage in moderation; *dessert* to consist of salads, fresh fruit, dried fruits without sugar, light wine in moderation, and black tea without milk and sugar; for *supper*, a cup of black tea without milk or sugar, an egg, or in its place a little fish, ham, or other fat meat, an ounce of well-buttered bread, a little cheese or fresh fruit. The use of fats is allowed, but the carbohydrates are to be avoided. Oertel and others have recommended a similar regimen. Dujardin-Beaumetz insists that a diet thus restricted is insufficient for healthy nutrition. When the different organs of the body have not undergone degeneration the patient is permitted to drink about half a pint of liquid with each meal. Wine, if taken, should be very light, and diluted with Vichy or other alkaline waters. If it appear undesirable thus to dilute the gastric juice, the patient should be directed to abstain from drink at meal-time, and he may be permitted, two hours after each meal, to drink a pint of weak tea without sugar. Strong alcoholic beverages and beer are forbidden. Sometimes a little black coffee is allowed at the close of the morning meal. Soups are not allowed, but eggs, fish, meat, fresh vegetables, and fruits that are not too starchy are permitted. Pastry is forbidden. Bread should consist largely of crusts; a favorite form is furnished by those slender rolls in which the crust forms the most considerable portion of their substance. *Breakfast* consists of three-quarters of an ounce of such bread, an ounce and a half of cold meat, and a cup of weak tea without sugar; *luncheon*, an ounce and a half of bread, three ounces of meat, or two eggs, the same quantity of fresh vegetables, salad, half an ounce of cheese, and fruit as desired; *dinner* in the evening, without soup, an ounce and three-quarters of bread, three ounces of meat, and other articles as at luncheon. Bouchard bases the treatment of obesity upon the condition of the urine. When the nitrogenous excreta are in excess, the amount of albuminous food should be reduced. When the urine exhibits a deficient quantity of urea the quantity of food should first be diminished, and then increased during the period of convalescence. In all cases the quantity of fat, starch, and sugar in the food

ld be five times the amount of nitrogenous nutriment. The quan-
of fat should be somewhat reduced, so as to avoid any unoxidized
lus; and for the same reason the quantity of sugar should be
ted, while the vegetable acids may be increased by giving fruits
fresh vegetables that contain organic salts of potassium, by which
process of oxidation is facilitated. Vinegar and other free acids
to be avoided, since their excessive use produces emaciation by
ruction of the calcareous framework of the cells. Acids in small
ntities aggravate obesity by diminishing the alkalinity of the body,
when combined with potassium the resulting salts favor oxidation
the destruction of fat. For the same reason food should not be
n too frequently or abundantly, and the patient should actively
rcise his muscles before meals. When, however, urea and phos-
tes are eliminated in excess, the processes of oxidation should not
nduly stimulated, and wine may be allowed.

n order to promote nutrition the trophic functions of the nervous
em must be aroused by agreeable occupation, travel, and other
les of intellectual excitement. Stimulation of the skin by friction,
rotherapy, and massage yield favorable results. The function
he liver must be regulated, in order to avoid constipation and to
r intestinal digestion. Carlsbad water and similar mineral waters
ch contain the carbonate and sulphate of sodium favor the assimila-
and oxidation of fats. In the same way bicarbonate of sodium,
or potassæ, and small quantities of soap are useful as aids to the
lation of fat. Warm baths, taken at a temperature of about 100° F.
a half-hour or longer, raise the temperature of the body, accelerate
absorption of oxygen, and promote the elimination of carbonic
.

n the majority of cases it is well to commence the treatment by
ucing the quantity of food, still preserving the proper proportion
ween its nitrogenous and its carbonaceous constituents. Milk and
s furnish the best diet for this purpose. The patient should take
twenty days in succession not more than half a pint of milk and one
every three hours during the waking portion of the day. No other
l or drink should be allowed. Under this treatment the bowels
ome constipated, and require gentle laxatives or enemata. At first
restriction of the diet causes sensations of faintness, weakness, and
etimes dizziness, but in a short time these unpleasant symptoms
ppear, and the disagreeable consequences of obesity rapidly
inish. At the end of three weeks the diet may be varied and
dually increased in accordance with the schedule previously quoted.

CHAPTER IV.

SACCHARINE DIABETES—DIABETES MELLITUS.

Diabetes is a general constitutional disorder, accompanied by persistent glycosuria, and usually characterized by an excessive discharge of urine, inordinate hunger and thirst, and progressive exhaustion.

SYMPTOMS. *Saccharine diabetes* commences in an insidious manner, so that only after a considerable period of time are the symptoms of disease sufficiently pronounced to excite attention or suspicion of their significance. In many instances the nature of the disorder is accidentally revealed through examination of the urine for some purpose disconnected with any idea of therapeutical treatment, as in cases of examination for life insurance which bring to light an unsuspected diabetes. In many instances the excellent appetite of the patient has quieted all apprehension of any other disorder than a trifling constipation; every meal is a source of satisfaction, and copious draughts of liquid are enjoyed with a gusto that is ascribed to the season of the year, or to the heat of the weather. Gradually, however, strength begins to fail; thirst increases; the mouth becomes dry; urine flows frequently and in greater abundance; and as it dries upon the clothing it leaves behind a white powdery deposit that arouses the curiosity of the victim. Sometimes there is an excessively annoying balanitis, or an intolerable itching about the vulva; the skin becomes dry through the suppression of perspiration; the nails are brittle, and sometimes fall from the fingers and toes without any apparent cause; obstinate itching eruptions of a lichenous character appear upon the surface of the body; boils, carbuncles, and gangrenous degeneration of the skin may occur; the sexual appetite disappears; the power of vision becomes enfeebled; emaciation progresses; or, if bodily weight be not diminished, muscular energy and the power of locomotion are greatly reduced. In this condition the patient gradually fails, and finally dies, either from exhaustion, or in a condition of coma, or as a result of various complications.

The mode of *invasion* is exceedingly variable, and so insidious is the *advance* of the disease that it is usually impossible to fix the date of its origin. When fully established, the concurrence of polyuria, glycosuria, excessive thirst, ravenous hunger, emaciation or exhaustion, constitute the most conspicuous and characteristic symptoms of the disease.

Diabetic urine is pale and opalescent; it exhales a sweetish, fruity odor, and when it contains from three to four per cent. of sugar its taste is unmistakably saccharine; the specific gravity is variable and without great diagnostic significance, though it is usually raised beyond the normal figure when the quantity of liquid is not inordinately increased by polyuria; its acidity is excessive, and is itself often a source of irritation and inflammation of the urinary organs, though such accidents

more frequently determined by fermentation of the highly saccharine
ıe.

The presence of *sugar* in the urine does not by itself determine the
stence of diabetes, since it may occasionally appear in the urine
ing the course of various maladies and intoxications of the body.
ly when *glycosuria* exists as a permanent symptom, or when the
ount of sugar that is voided during each successive period of twenty-
r hours surpasses the quantity that is daily formed by the liver in
lth (3000 grains), can the existence of genuine diabetes be affirmed.
e persistence of glycosuria is, however, the most important symptom,
though immense quantities of sugar are sometimes voided, in many
es the amount is comparatively insignificant. The urine that is
sed during the period of digestion is especially rich in sugar, but
ring the later stages of the disease the morning urine contains the
gest amount, formed at the expense of the tissues of the organism
ring the night, when the processes of disintegration are most active.
e occurrence of intercurrent diseases, or of slight disturbances of the
mentary canal, is frequently followed by temporary disappearance
the urinary sugar, a fact that must not be forgotten in estimating the
portance of such an incident.

The quantity of *urea* is often increased during the advance of the
ease, though it is greatly diminished during the period of terminal
chexia; this increase must be referred in part to the excessive appe-
e of the patient, and in part to the increased disintegration of the
trogenous elements of the tissues.

The waste of the albuminoid elements is accompanied by a corre-
onding discharge of *phosphates* with the urine; this process is but
ghtly influenced by the excessive appetite of the patient; it is prin-
ally controlled by the rate of destructive metamorphosis in the nitro-
nous constituents of the body. The elimination of urea and of phos-
ates is not always uniformly parallel; sometimes one substance is
excess, while the other is present in normal quantity; sometimes the
cess of phosphates alternates with that of sugar. It is supposed that
brittleness of the bones and their liability to fracture which is some-
es observed during the course of diabetes, can be explained by the
cessive removal of phosphates from their substance.

Albuminuria is frequently associated with glycosuria in the course
diabetes. In the later stages of the disease, and in certain special
es, it is the consequence of changes in the structure of the kidneys,
in the majority of instances the amount of albumin is very insignifi-
nt, and can only be detected by the most delicate tests. This form of
uminuria is frequently transient, and is accompanied by the char-
eristic signs of renal disease; it is in such cases an evidence of
praved nutrition, and it is among this class of patients that diabetic
hisis is encountered.

Uric acid is frequently present in excess during the course of
betes; this exaggerated excretion often precedes the appearance of
cosuria, and is one of the evidences of the relationship that exists
ween diabetes and gout.

Diabetic polyuria is characterized by frequent and excessive dis-

charge of urine, especially at night; the total amount that is voided during twenty-four hours varies from two to twelve or fifteen quarts; it varies according to the degree of thirst that is experienced. In severe cases the patient is consumed by an imperious desire for drink; the mouth is dry and sticky; the tongue is frequently smooth and red; the whole cavity of the mouth and pharynx appears slightly inflamed; the saliva is acid between meals, and sometimes contains sugar or lactic acid; the gums are softened and bleed easily; the teeth decay and fall from their sockets as a consequence of periostitis; thirst is most intense during the night and when the diet is rich in starch; it is diminished by flesh food.

The excessive *hunger* that is manifested by many diabetic patients is the consequence of the loss of sugar, urea, and salts. In certain cases the appetite is voracious, requiring each day not less than fifteen or twenty pounds of food for its complete satisfaction. Sometimes there is much suffering from gastralgia when the stomach is empty, and the pain can be relieved only by a hearty meal; in many such cases the stomach becomes considerably dilated, and the symptoms of catarrhal dyspepsia serve to aggravate the condition of the patient.

The *acidity of the gastric juice* is variable; in the later stages of the disease, when the gastric glands have undergone atrophy, there may be permanent absence of free hydrochloric acid; when the appetite is ravenous this acid is present in excess.

The *bowels* are habitually constipated by reason of the excessive discharge of water through the kidneys, and as a consequence of the reduction of bile which accompanies the general diminution of secretion throughout the body. Sometimes, however, diarrhœa occurs as a consequence of overloading the stomach, or under the influence of various nervous disturbances.

In the majority of cases the amount of *perspiration* is diminished by at least one-half; occasionally it is profuse, acid, and saccharine.

The presence of sugar serves to irritate the skin, and to favor the occurrence of *itching eruptions*, such as pruritus, erythema, psoriasis, herpes, eczema, lichen, and xanthoma. Many cases of symmetrical cutaneous œdema and erythema may be referred to peripheral neuritis, which especially involves the vasomotor nerves.

Boils, *carbuncles*, and *gangrene* are not uncommon incidents in the course of diabetes. The saccharine liquid with which the tissues are bathed affords a favorable medium for the multiplication of the micro-organisms of inflammation, suppuration, and putrefaction. For this reason the genital organs and cavities are frequently invaded by inflammation, ulceration, and gangrene.

The *temperature* is usually subnormal, and intercurrent febrile conditions are not accompanied by as considerable an elevation of temperature as is observed among other patients. This tendency is due to the reduction of the circulation through cardiac debility, to the excessive use of cold drinks, and to imperfect oxidation of the tissues.

The *absorption* of *oxygen* falls below the normal level, so that in the later stages of the disease scarcely half the amount that is absorbed in

alth is taken up by the tissues. A corresponding reduction in the *eration of carbonic acid and water* is also observed.

Notwithstanding the voracity of the appetite, the diabetic patient mplains of *muscular weakness*, *pain in the back*, and *cramps*. These mptoms are principally due to the condition of the *nervous system*, which all the functions are deteriorated. Symmetrical neuralgia is perienced in different parts of the body; the sciatic nerves are the vorite seats of such pain; it appears to be dependent, in many cases, pon the peripheral neuritis that is caused by the presence of an excesve amount of sugar in the blood. Various paræsthesias, pruritus, ain in the joints and in the back of the neck, together with an excesve sensibility to cold, have been frequently observed.

In many cases the *tendinous reflexes* are very much diminished or re totally abolished. In certain instances the patellar reflex is ntirely absent; this is an unfavorable symptom, and indicates great everity of the disease. Occasionally the patellar reflex is exaggerated, nd in such cases the appearance of sugar in the urine must be referred a lesion in the central nervous system, such as may be observed hen in the course of tabes dorsalis, or multiple sclerosis, the floor of he fourth ventricle is invaded by the degenerative process. In fact, lycosuria may be anticipated whenever the fourth ventricle becomes nvolved in the diseases of the brain and spinal cord.

Sometimes the symptoms of tabes dorsalis are manifested in the ourse of diabetes, constituting what is termed *pseudo-tabes;* this disder may be distinguished from genuine tabes by its rapid development, and by its subsidence under the influence of treatment addressed the amelioration of diabetic symptoms. Perforating ulcer of the ot, loss of the nails and of the hair, and other *trophic disturbances*, e the phenomena of pseudo-tabes, may be explained by the existence peripheral neuritis. Occasionally, brief *apoplectiform attacks* are llowed by hemiplegia; and attacks of syncope, sometimes associated th vertigo, have been observed. *Paralytic conditions* are sometimes veloped; they are usually transient, and restricted to a single muscle to a limited group of muscles; ptosis and strabismus may be thus oduced. Paroxysms of *asthma* and of severe *neuralgia* in the neighrhood of the heart sometimes recall the symptoms of angina pectoris. certain cases the patient experiences paroxysms of invincible *somnoce* which mark a tendency to the development of apoplectiform or matose symptoms. *Intellectual debility* and other forms of *mental sturbance* are sometimes witnessed.

The *heart* is affected in many cases. When the patient is vigorous d full-blooded, the organ may be hypertrophied, but in feeble indiduals it is usually dilated. When *obesity* exists, fatty degeneration d arterio-sclerosis invade the organs of circulation. In many cases docarditis appears, apparently as a consequence of prolonged irritaon by contact with blood that is overcharged with sugar; it is always dangerous symptom.

The *odor of the breath* is frequently perverted so that it resembles e odor of rotten apples.

Lobar pneumonia frequently occurs, and is an element of great

danger. A *fibrinous pneumonia* accompanied by dilatation of the bronchi, copious purulent secretion, and induration of the pulmonary parenchyma, has been observed. The various pulmonary and bronchial inflammations are sometimes followed by *gangrene*. The frequency with which *pulmonary consumption* is developed during the course of diabetes is worthy of note; it commences insidiously, progresses rapidly, produces few and insignificant symptoms, but destroys the lungs in a most effectual manner. In many cases the existence of the disease is not suspected until a physical examination reveals the extent of its ravages.

The function of *vision* is frequently disordered. Amblyopia, diplopia, paralysis of accommodation, dyschromatopsia, hemianopsia, retinitis, optic neuritis and atrophy, opacity of the vitreous humor, suppurative keratitis, iritis, irido-choroiditis, and cataract, may be enumerated among the diseases that invade the organs of vision.

Otalgia, *otitis*, and *deafness*, sometimes result from diabetes; and in like manner the senses of *smell* and of *taste* have been lost or perverted.

The *progress* of *diabetes* varies with the age of the patient; it is largely dependent upon the form of the disease; its course is very rapid among children, with whom it usually occurs shortly before the age of puberty; in such cases rapid emaciation is the rule, and *death* usually occurs within two years from the commencement of the disorder.

The concurrence of *diabetes* and *pregnancy* is attended with great danger; in one-third of the cases abortion occurs, and in half the cases delivery is followed by death from phthisis or coma. This grave form of diabetes differs widely from the transient glycosuria which is sometimes observed among young women during the period of lactation.

Excessive fatigue of mind and body favors the rapid progress of a dangerous form of diabetes. *Arthritic patients* who manifest a tendency to corpulence frequently survive from fifteen to thirty years after the commencement of the disease; but when the function of *pancreatic digestion* fails, the patient becomes rapidly emaciated and succumbs in the course of eighteen months or two years.

The two forms of diabetes thus indicated in the last paragraph stand in conspicuous contrast with each other. The *arthritic variety* is usually observed in persons who manifest a tendency to corpulence; it commences insidiously, the symptoms appear and disappear at intervals, and only after a considerable period are they fully confirmed and recognized; in many cases the disease is hereditary.

The *malignant form of diabetes* commences suddenly in the midst of apparent health; its course is rapid; the characteristic symptoms are conspicuous and unmistakable; emaciation and exhaustion are speedily developed; pulmonary consumption frequently appears, and death occurs at an early date. Heredity plays no part in this form of the disease.

In certain cases diabetes follows the course of *injury* or *concussion* involving the head and spinal column; the symptoms may be immediately developed; though many months, or even years, may sometimes intervene before their appearance. When the symptoms appear immediately after an injury, recovery generally occurs after three or four

nths; but when the disease is gradually developed after a consider-
le interval, its course is protracted, and recovery seldom occurs.
The *fatal termination* of diabetes is frequently caused by suppura-
n or by gangrenous processes that are dependent upon parasitic inva-
n. Pulmonary tuberculosis and diseases of the liver or kidneys are
mmon causes of death. In many cases the final result is suddenly
ached through the intervention of diabetic coma.

Diabetic Coma. In rather more than half the cases of diabetes the
sease terminates fatally, after the development of a form of coma
hich occurs under such circumstances and presents such characteristic
mptoms that it deserves the special appellation which it has received.
usually originates suddenly after some form of fatiguing exercise; it
ten follows a journey or other unusual mode of activity on the part of
enfeebled patient; it is to be apprehended whenever the quantity of
ine diminishes without a corresponding reduction in the amount of
gar that is voided; it may also follow an intercurrent disorder that
ercises a depressive effect upon the nervous system; it has been
ged that therapeutic measures which result in the reduction of
cosuria, favor the development of coma.
The sudden *cardiac collapse* that sometimes overtakes diabetic
ients must not be confounded with genuine diabetic coma. Col-
se occurs as a consequence of fatty degeneration of the heart. It
haracterized by the ordinary symptoms of cardiac failure, and is
erally followed by death in the course of twenty-four or forty-eight
rs, and it is a consequence of the general tendency to obesity and
y degeneration which characterizes certain forms of diabetes.
True diabetic coma is generally observed in the course of that form
the disease which is marked by rapid emaciation and cachexia. The
elopment of coma is preceded by a peculiar, chloroform-like odor
the breath and of the urine. The urinary secretion is reduced in
ntity, and contains less sugar than is ordinarily voided. Sometimes
re is albumin present, and the liquid assumes a deep, port-wine color
the addition of perchloride of iron. Severe dyspnœa is also mani-
ed, though respiration often exhibits no acceleration, and the patient
ble to maintain the recumbent position. The physical signs afforded
auscultation are normal—in fact, the phenomenon is an evidence
a morbid state of the blood, by which the nervous system is excited,
the respiratory movements are deranged.
In like manner the pulse shows very little disturbance, and the
perature falls gradually, perhaps after a transient moderate eleva-
n. The gastro-intestinal mucous membrane exhibits signs of disor-
which usually assume the form of nausea, vomiting, and diarrhœa.
metimes the abdomen is distended and painful upon pressure, but no
mptoms of inflammation or fever arise.
Sometimes the attack is followed by a slight degree of exhilaration
exaltation of the mental faculties, but this is soon succeeded by
nolence and coma. Among young children convulsions have been
metimes observed.
When coma has been fully developed, the patient lies motionless,

with dilated pupils that react to the light; the extremities are cold; the surface of the body is cool; the muscles are completely relaxed; the temperature falls, and death occurs within three or four days. Occasionally the period of coma is preceded by headache, vertigo, and sensations like those of alcoholic intoxication; alcohol in such cases has been found in the urine.

A *chronic form* of diabetic intoxication has been described. It is characterized by a prolonged period of prostration, dyspnœa, distended abdomen, and a peculiar odor of acetone upon the breath. Sometimes these phenomena appear and disappear at intervals for some time before the final development of fatal coma.

Pathological Anatomy. In the majority of cases the *brain* is diseased, but the morbid appearances are usually the consequence rather than the cause of diabetes. Among such lesions may be mentioned œdema, congestion, and thickening of the meninges; anæmia, atrophy, and softening of the convolutions; sclerosis, amyloid and colloid degeneration of the cerebral tissues. *Cystic growths* have been observed in various portions of the brain, but the *tumors* which have been occasionally observed in the bulb and fourth ventricle have doubtless been largely concerned in the causation of glycosuria. In certain cases the vessels of the bulb and of the brain are obstructed by *emboli* masses of *glycogen* which may have been concerned in the production of various nervous phenomena connected with the course of the disease. The *spinal cord* exhibits no characteristic lesions, but the *cranial nerves* are sometimes compressed by tumors which probably occasion certain phenomena of the disease. The *spinal nerves* are sometimes inflamed, probably as a consequence of the excessive presence of sugar in the blood by which they are irrigated. The *ganglia of the sympathetic nerves* are sometimes enlarged and indurated.

The *blood* is usually unchanged in appearance; the number of red blood corpuscles is not diminished until a late period in the course of the disease; the white blood corpuscles are often increased in number.

The characteristic change in the blood is produced by the excessive presence of *sugar;* its amount is subject to very considerable variation (0.35 gr. to 5.3 gr. per thousand). *Urea* and other nitrogenous excreta are frequently present in excess. *Acetone* is occasionally observed.

The *heart* is pale and soft, or enlarged, or fat, in 50 per cent. of the cases. Sometimes pericarditis and endocarditis have been observed. The *arteries* frequently exhibit fatty degeneration or atheroma. The *liver* is frequently enlarged and fat. Cirrhosis is not uncommon, and pigmentary degeneration sometimes occurs. The *spleen* is usually small and soft; its arteries exhibit hyaline degeneration. The *pancreas* frequently exhibits more or less complete atrophy, which is sometimes the consequence of sclerosis of the connective tissue; in certain cases it is the result of obstruction of the excretory ducts by calculi; in other cases cysts are produced by dilatation of the obstructed ducts. Compression of the pancreatic duct by any form of tumor or exudation may result in atrophy of the organ, and in the development of malignant diabetes characterized by rapid emaciation

l an early death. Mere obstruction of the pancreatic duct is not ally followed by glycosuria, but it is almost invariably observed en the suppression of secretion is due to perivascular sclerosis—a ion that is equivalent to a total extirpation of the organ. The cous membrane of the *stomach* and of the *intestines* frequently ibits a condition of chronic catarrh. The *lungs* and *bronchi* are n inflamed, but more frequently they are the seat of tubercular ltration. The *kidneys* are frequently diseased. In certain cases onic nephritis exists as an accidental complication of diabetes, but in ny instances the lesions are the direct result of the disease. Some- es the epithelium of the convoluted tubules and of certain portions he straight tubules exhibits a granular degeneration similar to that oagulative necrosis. In many other cases the epithelial cells of se portions of the uriniferous tubules that lie within the marginal e are enlarged by infiltration with glycogen.

The mucous membrane of the entire *uriniferous tract* is frequently nd in a condition of chronic inflammation. *Balanitis* and *vulvitis* not uncommon.

Various *cutaneous diseases* are frequently developed during the rse of diabetes. Among them is a species of lichen that resembles thelasma. Parasitic diseases, such as boils, carbuncles, phlegmons, gangrene, are of frequent occurrence. In the *eye*, cataract is the st frequent lesion. Sometimes retinal hemorrhage occurs, and the ina or the optic nerve may undergo simple atrophy.

ETIOLOGY. *Differences of climate* exert very little influence upon occurrence of diabetes, yet there are localities in which the disease encountered more frequently than elsewhere. This fact may gener- y be explained by the existence of different modes of alimentation, d perhaps by the greater predisposition of certain families and races arthritic disorders. The *excessive use of saccharine and starchy od* has been assigned as a cause of diabetes, but it may be more cor- ctly stated that every form of habitual excess in the matter of diet eates a predisposition to diabetes through the defective nutrition that thus produced. For this reason, the *excessive consumption of meat*, pecially when taken together with copious draughts of beer and wine, a fruitful cause of disorder which may culminate in diabetes. Such predisposition is also favored by sedentary habits and insufficient uscular exercise. *Hereditary influences* are as evident in this con- ction as they are in other diseases of nutrition, like obesity, gout, eumatism, lithiasis, asthma, eczema, and hæmorrhoids. The disease also not uncommon among the members of neurotic families in which ntal derangement, epilepsy, paralysis agitans, exophthalmic goitre, d hysteria have been observed. The *coexistence of obesity and betes* has been frequently noted. The influence of *sex* is quite insig- icant, but the predisposition of *age* is well marked; the disease most quently occurs during the period between fifty and seventy years.

The *exciting causes* of diabetes are frequently found in acute and onic diseases of the nervous centres, tumors, and injuries, princi- ly those which involve the fourth ventricle.

Diabetes may be excited by *psychical causes*, especially by those of a

presence may be determined by the well-known fermenta
the use of the polariscope or saccharimeter. Numerous
have also been employed, but of these the most useful
practicable is *Fehling's solution*. When properly
cubic centimetre of the solution is reduced by five m
glucose. The test may be applied by first boiling a
reagent in a test tube; if it remain unchanged by ebull
trusted for an accurate result. The suspected urine s
poured slowly down the side of the inclined tube so th
upon the surface of the reagent. If then the urine cont
able quantity of sugar, the surfaces in contact are define
film that rapidly changes to a yellow, orange, and, finall
as the process of reduction extends itself. If but little su
the contents of the test-tube must be boiled for a few sec

If *albumin* be present, reduction of the cupro-potass
not be effected. Albumin must be first removed by coa
precipitation with the subacetate of lead. *Ammoniac*
first be removed by boiling the suspected urine with a litt
after which the test may be conducted as usual. *Uri*
urates, when precipitated, should be removed by filtratio
the addition of subacetate of lead, which, at the same ti
albumin.

The urine of patients who have inhaled chloroform or
or who have taken chloral hydrate, reduces Fehling's so
phemonenon is transient, and may be readily explained b
the previous history of the patient.

Having determined the existence of *glycosuria*, it i
ascertain whether it be a permanent condition, or whethe
the result of accidental excesses in the use of sugar-yield
an imperfect action of the digestive organs. Glycosuri

ice arthritic cases are usually less rapid in their course than those hich exhibit a tendency to emaciation and tuberculosis. The occurnce of obesity, gout, lithiasis, etc., are also important in this conction, since their existence requires a special dietary and regulation the habits of life. Diabetes that is dependent upon sedentary habits d excessive alimentation is less rebellious to treatment than when sociated with hereditary arthritic tendencies.

When the disease is dependent upon psychical or neurotic causes, or on shocks and injuries affecting the nervous system, the prognosis d treatment should be largely influenced by these considerations, nce the restoration of health to the nervous system may be followed recovery from diabetes.

Diabetic patients should be frequently weighed in order to ascertain hether the rate of tissue waste exceeds that of nutrition. In like anner the condition of the skin furnishes valuable information regardg the state of nutrition. The absence of the tendinous reflexes is an nfavorable symptom. Insomnia, disappearance of sexual appetite, ss of memory, failure of the special senses, are all important elements the estimation of the case. Especially important is the examination the lungs, since latent tuberculosis is not uncommon.

Varieties of Diabetes. It is well known that in the lower animals *lycosuria* can be produced by puncture of the floor of the fourth venicle, below the pneumogastric nucleus. It may also be produced by injuries involving the spinal axis at various points between the optic alami and the lower extremity of the cord, the larger peripheral erves, and the sympathetic ganglia. It is probable that many cases of iabetes are thus originated by local injuries of the central nervous ystem.

Various *toxic agents* may also produce the discharge of sugar with e urine; among these may be mentioned curare, carbon monoxide, hloroform, nitrite of amyl, methyldelphinine, hydrochloric and phosphoric acids, turpentine, corrosive sublimate, nitrate of uranium, orphine, strychnine, hydrate of chloral, phloridzine, and lactic acid.

The existence of glycosuria has been ascribed to the excessive use of gar and starch, but since it has been shown that in a healthy conition of the digestive organs no special consequence follows the exssive ingestion of such food, many physiologists have sought to explain e existence of glycosuria by assuming a chronic disorder of the imentary canal, and of its associated glandular organs, the liver and e pancreas. This theory has received considerable support from the bservation that *extirpation of the pancreas* in the lower animals proaces permanent diabetes; but it does not explain those cases in which e pancreas remains healthy, and in which there is an obvious conction with disorders of the nervous system, or with the existence of thritic tendencies. It has been conjectured that in health a ferment furnished by the pancreas that transforms the glucose in the blood, d that the abolition of pancreatic function occasions diabetes through e absence of that ferment and the consequent overloading of the blood th unchanged glucose.

Another hypothesis indicates the *liver* as the source of the disorder.

According to this explanation it is supposed that the liver is rendered incapable of transforming the saccharine elements of the food into glycogen, hence the blood becomes overcharged with glucose.

According to another hypothesis the liver is represented in a state of abnormal activity, producing an excessive amount of glycogen and dispensing to the blood a correspondingly inordinate quantity of glucose. The presence of a special ferment has been imagined to account for this transformation of hepatic glycogen into glucose.

In certain cases it has been conjectured that the excess of glucose in the blood was due to an *inordinate transformation of muscular glycogen* into glucose.

Other hypotheses have been constructed upon the basis of a supposed *failure in the process by which glucose is destroyed* in the organism. Pettenkofer and Voit have suggested that when the albuminoid constituents of the body undergo oxidation under normal conditions they furnish fat, but that when an insufficient quantity of oxygen is present, sugar is the resulting product. Others have supposed that it is in the muscular substances that this imperfect oxidation takes place, and that diabetes results as a consequence of the abnormal liberation of the elements of urea and sugar in those organs. A serious defect in this hypothesis consists in the failure to recognize that diabetes is not always associated with a redundancy of nitrogenous elements in the urine.

The accumulation of diabetic sugar in the blood has been ascribed to *imperfect respiration* and to the consequent reduction of the processes of oxidation in the lungs. This hypothesis is weakened by the well-known fact that pulmonary consumption does not increase the amount of sugar in the urine, but is, on the contrary, followed by a reduction in its amount. Others have ascribed the accumulation of sugar in the blood to a supposed lack of alkalinity in that fluid. Recently a conjectural failure of energy on the part of the blood serum has been alleged as an explanation of various errors of nutrition. According to this hypothesis, if the blood serum is unable to assimilate hydrocarbons, *glycosuria* is developed; if incapable of assimilating fats, *obesity* follows. If, in like manner, ammoniacal nitrogenous compounds cannot be incorporated, there will be an excess of *nitrogenous* excreta in the urine. If albuminous compounds composed of the three former elementary substances cannot be transformed and assimilated, *albuminuria* is the consequence.

Various authors have endeavored to reconcile these numerous hypotheses by incorporating them into a theory which recognizes numerous types of diabetes. According to Seegen the *minor forms of diabetes* are the result of a *failure on the part of the hepatic cells* to effect the normal transformation into glycogen of the hydrocarbonaceous elements of the food; while in the *severe and malignant forms* of the disease, not only the liver, but all the cells of the organism have lost their power to dispose of the saccharine element of the blood.

The *cause of diabetic coma* remains undiscovered. It has been ascribed to the action of *acetone*, which is undoubtedly present in the urine of patients whose breath and urine exhales an ethereal odor.

substance, however, is frequently absent when coma appears, and often present when no signs of coma, or even of diabetes, are ifested. When administered in large doses it produces no poisonous ts.

Diabetic coma has been ascribed to the action of *diacetic acid*, but same objections that have been urged against the agency of acetone also be brought to bear upon this substance. *Oxybutyric acid* has been incriminated as the active agent in the production of coma, in absence of sufficient ammonia to effect its saturation.

These various and complicated hypotheses are sufficient evidence of ignorance regarding the cause of diabetic coma. It is, however, oubtedly true that the condition is a symptom of auto-intoxication. h these reservations, the term *acetonæmia* may be employed to indi- the complex and unknown causes of diabetic coma, just as the n *uræmia* is with corresponding ignorance employed to indicate the lerlying conditions of renal coma.

TREATMENT. The treatment of diabetes is dietetic and pharma- tical.

Since the greater portion of the glucose in the blood is derived from charine and starchy substances, these elements should be excluded n the food of the diabetic patient. As substitutes for sugar, saccha- e is often useful, but it frequently fails by reason of the dislike for its te that is manifested by many patients. Glycerine is sometimes ful as a substitute for syrups.

Fruits and vegetables rich in starch and sugar must be interdicted, .: potatoes, rice, preparations of flour and starch, beans, pease, tils, chestnuts, turnips, radishes, grapes, plums, apricots, pears, les, melons, figs, strawberries, cherries, gooseberries, raspberries, rots, beets, onions, tomatoes, and asparagus.

The following articles may be allowed: all kinds of butcher's meat, ue, poultry, fish, oysters, clams, eggs, bacon, butter, fats, glycerine, nach, chicory, cabbage, cauliflower, water cresses, lettuce and other d plants, the different kinds of cheese, olives, nuts, unsweetened colate, and table salt, for which may be substituted tartrate of ium, citrate of sodium, and phosphate of calcium.

All beverages that contain sugar must be forbidden, viz.: lemonade, mpagne, beer, cider, aërated waters, and milk, though skimmed has been recommended by Donkin as a beneficial article of diet; ıse, however, has not been attended with satisfactory results.

Water and unsweetened coffee or tea may be allowed. Alcohol ıld be avoided on account of the injurious influence that it exerts upon liver. Water may be allowed freely, since it assists in the elimina- of sugar, and if it be denied, the tissues are rapidly dehydrated.

Bread made with gluten flour has been highly recommended, but it esses the great disadvantage of being exceedingly distasteful, and e to disorder digestion; it also contains so much starch that it is rior to potatoes as an article of diet. The carbonate of potassium h exists in the potato is a salt of great value as an aid to the assimila- of sugar, consequently the potato may be allowed in moderation as

a substitute for ordinary bread. Cakes made of almond flour have been recommended.

Simple glycosuria may be undoubtedly cured according to the method of Cantani by restricting the patient to a diet of meat and fat; but in genuine diabetes such a restricted regimen is dangerous, since it occasions other disorders, and is supposed by many to create a predisposition to diabetic coma. Naunyn distinguishes three forms of diabetes: severe, moderate, and mild. In the severe form of the disease he recommends the method of Cantani, so long as the urine is not reddened by the addition of perchloride of iron, a symptom that indicates the imminence of diabetic coma. In moderate cases, after the disappearance of sugar under a flesh diet, he permits the use of eggs, milk, and a small quantity of bread. In mild forms of the disease greater liberty is allowed, but the urine must be continually watched, and the reappearance of sugar serves as a signal for greater caution in the matter of diet. He allows salads, string-beans, mushrooms, pears, and apples. Beer is interdicted, and milk is only allowed when it does not increase the amount of sugar in the urine. In mild forms of the disease the daily ration consists of sixteen or eighteen ounces of meat, one to three ounces of bread, three or four ounces of vegetables twice a day, or an equal quantity of salad or apples.

Active exercise, gymnastics, and massage are useful, since they aid the processes of oxidation in the organism. Warm baths should be taken three times a week. The clothing must be sufficient to prevent those chills that are so deleterious in cases of diabetes. All violent emotion must be avoided. Residence in a warm climate during the winter season affords favorable results.

Pharmaceutical Treatment. The employment of alkaline remedies favors the process of oxidation within the organism. They are especially useful in recent cases, not too far advanced in years, who are vigorous, fleshy and plethoric, with a predisposition to arthritic diseases, and with urine rich in uric acid. Lime-water may be drank in large quantities by such patients. Magnesia, aqua ammoniæ (six drops three times a day), carbonate of ammonium (fifteen to eighty grains), bicarbonate of sodium (one and a half to three drachms), the citrate, tartrate, malate, and bicarbonate of potassium, sodium, or lithium, are all valuable alkaline salts; hence the utility of Vichy water and similar mineral waters. Bicarbonate of sodium is prescribed in cases of diabetic coma by those who refer its manifestation to the excessive presence of acids in the tissues. When there is excessive production of urea and other nitrogenous excrementitious substances, alkalies and alkaline mineral waters diminish the amount of uric acid and sugar. Digestion improves, emaciated patients increase in weight, while the obese become less corpulent. When, however, the processes of oxidation are evidently depressed, alkaline remedies should be withdrawn.

Opium and its derivatives are exceedingly potent to relieve thirst and hunger, and to diminish the amount of sugar in the urine. Codeine is recommended when the urine contains an inordinate amount of nitrogenous substances; it may be given in large doses if associated with strychnine. Belladonna is sometimes beneficial in recent cases,

it is useless or often injurious in advanced cases, especially when kidneys are diseased.

Strychnine is useful in cases of debility, with enfeeblement of the ual, digestive, or generative organs.

Laxatives and purgatives must be used with great caution, since they liable to aggravate the existing glycosuria.

Valerian diminishes thirst and polyuria. It is exceedingly useful ien urea is eliminated in excessive amount. Arsenic and its salts ve been frequently prescribed, but its use is often followed by disap- intment. Iodine in the form of compound tincture has been recom- ended in doses of five to twenty drops before meals. Mercury is use- l in syphilitic cases. Many other alterative remedies have been vised, such as the mineral acids, salicylate of sodium, carbolic acid, loral, cocaine, astringents, ferments like yeast, diastase and pepsin, mbul, permanganate of potassium, peroxide of hydrogen, ozonized ber, inhalations of oxygen, etc.

Remedies addressed to the nervous system have been employed with reater or less effect. Antipyrine, in doses of forty-five grains a day, uses a rapid reduction of glycosuria; it is useless in tubercular sub- cts and in cases characterized by emaciation. The salts of quinia, pecially the valerianate, have been recommended, in doses of three to n grains a day. Bromide of potassium is indicated when the disease associated with disorders of the bulb. Hypodermic injections of the uid extract of ergot have also been recommended. Electricity has een employed in every possible way; under its influence sugar some- mes diminishes in the urine. Blisters and similar counter-irritants hould be avoided, since they favor the occurrence of gangrene at the oint of vesication. Thus treated, diabetes is curable, for a time at east, in fifty per cent. of the cases.

CHAPTER V.

POLYURIA—DIABETES INSIPIDUS.

Diabetes insipidus is a constitutional disease characterized by an crease of urine, thirst, excessive craving for liquids, and accompanied a variable proportion of the soluble constituents of the urine. In rtain cases a small quantity of inosite, or muscle sugar, is contained the urine. Sometimes there is an inordinate discharge of the nitro- nous excreta; or the saline constituents may be increased in amount. olyuria accompanied by albumin in the urine is due to the existence interstitial nephritis, or may be the consequence of neurotic or thritic conditions of the system.

SYMPTOMS. *Simple polyuria* is characterized by an increased dis- arge of urine. The desire to urinate recurs at comparatively short tervals, and the quantity of liquid that is discharged may be increased

from two- to tenfold. The water is light yellow or nearly colorless, of acid reaction, speedily becoming neutral or alkaline after exposure to the air, with a specific gravity little above that of pure water, seldom reaching 1010. The solid constituents, though relatively diminished, are often absolutely increased. Occasionally sugar may be present for a brief period. The occurrence of albumin must be referred to actual inflammation of the kidney itself when its presence cannot be explained by the occurrence of hemorrhage or exudation in the course of the urinary tract.

Extraordinary thirst is a very common symptom in the course of polyuria. The mouth and throat are dry and sticky; *perspiration* is diminished; the *temperature* of the body is frequently subnormal; when the disease occurs in childhood the *growth* of the body is retarded and incomplete; the *appetite* is irregular and perverted; gastric and intestinal *digestion* are usually disordered; sometimes there is complaint of *headache*, dizziness, and diminished power of mental application; the *sixth nerve* is frequently paralyzed, and sometimes other cranial nerves are similarly affected; the *reflexes* may be absent; in certain cases *hemorrhages* are observed in the retina, and *neuro-retinitis* and *atrophy* of the *optic nerve* occur; *hemianopsia* and *amblyopia* are not uncommon, but the occurrence of *cataract* is a rare event.

In certain cases the nitrogenous constituents of the urine are greatly increased in amount. The symptoms closely resemble the classical picture of saccharine diabetes. There is increase in the quantity of urine; great thirst; voracious appetite; progressive emaciation; dryness of the skin; disturbances of the nervous system; and frequently a rapid development of phthisis. The urine, however, contains no sugar, but is heavily charged with urea.

The disease usually commences gradually, but sometimes its onset is sudden and abrupt. The amount of *urine* is always less than the quantity of liquid that is drank, and it varies according to the quantity of urea that is excreted. Its color is light yellow; it is transparent and acid when it is voided, but soon becomes turbid and ammoniacal in consequence of the presence of mucus and epithelium thrown off from the urinary passages under the influence of the irritation excited by the excrementitious constituents of the fluid. The specific gravity varies from 1002 to 1050. The urinary sediment contains urates, uric acid, and sometimes oxalate of calcium. The daily discharge of urea varies from an ounce and a half to three ounces, with a considerable margin above and below these figures. Uric acid is seldom increased to any great extent, but the other nitrogenous excreta and the chlorides and phosphates are present in excess. A considerable portion of this excessive waste must be referred to the inordinate amount of food that is consumed by many of these patients.

The patient complains of *fatigue* and *progressive debility*. He becomes gradually emaciated; the skin is pale and dry; the extremities are frequently livid by reason of the enfeeblement of the action of the heart; active exercise becomes impossible, and the temperature is frequently subnormal; headache is sometimes constant or of frequent occurrence; hemorrhage, pruritus, various perversions of sensation in

the skin and mucous membranes, enfeeblement of the special senses, amblyopia with or without visible lesions, are sometimes present; impotence is an almost constant symptom; besides headache and insomnia, vertigo is often experienced, and the intellectual faculties are gradually extinguished; sometimes tremors, spasms, or general convulsions occur, and death may be preceded by coma.

The disease is usually chronic. The patient becomes emaciated, or finally dropsical. With the failure of appetite and of digestion the quantity of urea diminishes. *Death* may be occasioned by exhaustion, hemorrhage, gangrene, convulsions, coma, or by pulmonary consumption. In rare instances a *cure* has been effected by the intercurrence of some acute infective disease, or by the action of valerian or opium.

Phosphatic diabetes (diabetes with phosphaturia) is generally developed in the course of tuberculosis or of nervous disorder. The urine contains ammonio-magnesian phosphates; and, if urates and oxalates are in excess, an iridescent film appears upon the surface of the liquid after standing for some time. In certain cases the disease is related to glycosuria. The patients present many of the symptoms of saccharine diabetes, and sugar may have been, or will be, found in the urine. The excessive elimination of phosphates has been ascribed to the splitting up of glucose within the organism into lactic acid, by which the salts are rendered more soluble and diffusible. The phosphatic diabetes that occurs among children and young people is frequently associated with oxaluria and with excessive discharge of uric acid. Sometimes traces of albumin are also apparent. These symptoms indicate the existence of a predisposition to gout or to gouty disorders.

Oxaluria. Closely related with the different forms of diabetes is an error of nutrition which is characterized by the appearance of *oxalate of calcium in the urine.* The predisposition is frequently hereditary, and may either alternate or coincide with the appearance of diabetes. The excessive use of aërated mineral waters and vegetables, like rhubarb, that contain oxalic acid, is frequently followed by an abundant discharge of the crystals of calcium oxalate in the urine. Patients who suffer with gout, tuberculosis, hypochondria, obesity, and a voracious appetite, are frequently subject to oxaluria. A small quantity of oxalic acid exists normally in the blood and is there destroyed; but if an excess of calcium compounds are encountered in the circulation, the oxalic acid enters into combination with the calcium, and, held in solution by phosphate of sodium, is eliminated through the urine. In this way the normal excretion of oxalic acid is sometimes increased twenty-five-fold.

The *symptoms of oxaluria* are characterized by great muscular weakness and nervous exhaustion. An acid and offensive perspiration accompanies slight efforts. The expression of the countenance indicates fatigue. The repose of night brings no increase of vigor, and during the day there is an invincible inclination to sleep. The breath is frequently offensive; the skin is imperfectly nourished; the hands tremble; the phenomena of gastric neurasthenia are developed; in severe cases there is rapid emaciation, in consequence of the excessive

elimination of the calcic and phosphatic salts which are required for the maintenance of the tissue.

PATHOLOGICAL ANATOMY. Characteristic pathological changes are wanting in cases of *diabetes insipidus*. In certain instances the *solar plexus* has been found in a condition of degeneration with proliferation of its connective tissue. The *kidneys* are frequently enlarged and engorged with blood. The *uriniferous tubules* are sometimes dilated, and their epithelium may be in a condition of fatty degeneration, but these changes do not explain the symptoms, nor throw any light upon the nature of the disease.

ETIOLOGY. *Diabetes insipidus* occurs two or three times more frequently among men than among women. It is a disease of middle life, though it sometimes originates in early childhood. The influence of heredity is well marked, and in certain families saccharine diabetes and simple polyuria alternate with one another. All forms of *injury* and *disease of the nervous system* may be followed by one or the other form of diabetes. The *infective diseases* and *chronic intoxication with lead or alcohol* may be followed by polyuria. In many cases the disease follows *exposure to cold or to excessive heat*, *sudden chilling of the body*, or any other form of *shock* or *agitation of the nervous system*.

DIAGNOSIS. The recognition of diabetes insipidus is easy, if the urine be subjected to chemical analysis. The disease must be distinguished from *saccharine diabetes* and from *chronic inflammation of the kidneys*, principally by the results of urinalysis. From *transient polyuria* and from *primary polydipsia* it may be distinguished by the history of the patient, and by the fact that the excess of urine is immediately connected with the gratification of the desire for drink. *Oxaluria*, *phosphaturia*, and other varieties of urinary disorder, can only be recognized by urinalysis in connection with the characteristic symptoms of disordered nutrition.

PROGNOSIS. Recovery is an uncommon event, though the effects of treatment are frequently beneficial, if not permanent. The more rapid the emaciation and exhaustion, the more unfavorable are the prospects, though life is frequently prolonged for many years.

TREATMENT. *Simple polyuria* is favorably influenced by the administration of antipyrine (fifteen grains every four hours). Lead and opium are less efficacious. The diet should be abundant and nutritious, and thirst may be relieved by acidulated drinks. *Polyuria* with an excess of *nitrogenous waste* requires an abundance of nitrogenous and starchy food. Quinine, arsenic, and codeine, especially when combined with strychnine, favor the resumption of healthy nutrition. Especially useful is valerian, of which the extract may be given in divided doses to the amount of an ounce in twenty-four hours. In syphilitic cases mercurial inunctions and iodide of potassium must be employed, but not otherwise.

Phosphaturia must be subjected to various forms of treatment in accordance with its cause. When dependent upon tuberculosis the progress of infection must be retarded by the ordinary methods. In cases of nervous excitement, bromide of potassium and other nervines are useful. When there is an excessive production of acid in the system

alkalies and alkaline salts are useful. The food should be rich phosphates, and for this reason whole-meal flour, eggs, and fish may employed. *Oxaluria* requires attention to the diet, in order to avoid introduction of oxalic acid with the food; pie-plant and similar bstances must be forbidden. Alkalies and alkaline salts favor nutri-n, but calcium salts must not be administered. Moderate doses of dium or potassium bicarbonate may be given with advantage for ten ys in each month; if administered continuously they may occasion e precipitation of earthy phosphates in the urine. Acid dyspepsia ay be relieved by antiseptic remedies, such as naphthaline or the licylate of bismuth. Dilute nitric or hydrochloric acids are useful r the relief of dyspepsia, since they diminish the excessive production acid in the alimentary canal.

The most favorable results, however, are secured by the improve-ent of nutrition that follows moderation in eating, copious draughts hot water at bedtime, regular exercise in the open air, massage and mnastics, sponging with salt water, change of residence and occu-tion, and all other methods that serve to tranquillize the mind and vigorate the body.

CHAPTER VI.

GOUT—ARTHRITIS URATICA.

So numerous and so varied are the manifestations of *gout* that it ecomes impossible to furnish a brief and accurate definition that shall clude all its varieties. It is always a chronic disease that persists uring the whole of life when its origin is hereditary, and throughout ie remainder of life when it has been acquired after birth. Its more nspicuous outbreaks are to be considered as exacerbations or exagger-tions of a morbid process by which the nutrition of the organism is tarded and perverted. It belongs to that remarkable group of dis-ses which may be associated either in the same individual or among embers of the same family who have derived their morbid predispo-tion from a common source. Among these disorders are included rtain cutaneous diseases—eczema, impetigo, erythema, urticaria, and e allied mucous inflammations of the respiratory tract; also chronic id dyspepsia, congestion of the liver, lithiasis, hæmorrhoids, neural-a, hemicrania, congestive headaches, acute, chronic, and muscular eumatism, asthma, obesity, diabetes, and gout. These maladies all pend upon a peculiar retardation of nutrition that characterizes the thritic diathesis. In the present state of our knowledge it is impos-ble to explain the manner in which are produced the different vices of trition that determine the appearance of diabetes in one patient, hile another suffers with obesity, and a third becomes gouty. That ese nutritive errors depend upon closely related and interchangeable uses seems to be indicated by the frequency with which a patient may

exhibit these disorders in succession, and also by the frequency with which they alternate with each other in the course of successive generations. The gouty patient may become the victim of obesity, and the diabetic patient may give birth to gouty offspring, etc.

ETIOLOGY. *Gout* is a disease that is unknown among temperate and active races. It prevails among the wealthy inhabitants of large cities where luxury and self-indulgence are the favorite vices of the population. This tendency, which is based upon the excessive consumption of highly seasoned food, is greatly aggravated by the concurrent use of alcoholic stimulants, especially wine and beer. Active intellectual pursuits, debauchery, and the exhaustion that results from the mad race after wealth and fame, contribute largely to undermine the system, and to excite the disease. For this reason it is far more frequently encountered among men than among women. The sedentary life of the luxurious female predisposes to biliary lithiasis and obesity, but rarely extends to the production of gout.

Gout has been experienced at almost every period of life. It is, however, more commonly observed during the period of active adult life. Hereditary influences exercise great influence upon the manifestation of the disease. About half the cases can be traced to a gouty ancestry. This tendency appears to be more frequently transmitted through the paternal line. According to the statistics collected by Bouchard, among the ancestors of gouty patients, obesity may be discovered in 44 per cent.; rheumatism, 24 per cent.; asthma, 19 per cent.; diabetes, eczema, and gravel, 12.5 per cent.; biliary lithiasis, hæmorrhoids, and neuralgia, 6 per cent. In only 12 per cent. of the cases was no hereditary arthritic disease discovered.

Among gouty patients themselves, obesity and dyspepsia have been noted in 31 per cent. of the cases; gravel, in 28 per cent.; hemicrania and eczema, in 19 per cent.; neuralgia, in 12 per cent.; acute and muscular rheumatism and asthma, in 19 per cent.; chronic rheumatism, hemorrhage, and urticaria, in 6 per cent.; diabetes, in 3 per cent.

Besides the frequent association of the diseases thus mentioned, there is a notable relation between gout and the occurrence of cancerous disease of the rectum and bladder. This complication is usually developed between the ages of fifty and sixty years. The ordinary gouty symptoms by which the patient has been tormented disappear, and are replaced by the characteristic sufferings that accompany the evolution of carcinoma.

SYMPTOMS. A broad distinction must be maintained between the *gouty diathesis* and the manifestations of *gout* itself. *Diathesis* is merely a convenient term by which is designated a predisposition that may be either inherited or acquired.

During the early *infancy of children who have inherited the arthritic diathesis*, there is a marked tendency to the occurrence of eczema and of impetigo. In this respect there is a strong resemblance between scrofulous and arthritic subjects, probably on account of the fact that in both there is an analogous disturbance of the nutritive processes. *After the period of first dentition*, catarrhal inflammations of the respiratory tract are exceedingly common. As the age of puberty is

roached, articular rheumatism sometimes occurs. Epistaxis is fre-
nt, and headache is often experienced. If gonorrhœa be contracted,
s exceedingly persistent and difficult of cure. Among gouty patients,
ple catarrhal inflammations of the urethra, often accompanied by
petic eruptions on the glans penis, are not uncommon. These in-
mations often complicate the mucous membrane of the bladder and
lidymis. *About the age of twenty-five years*, a peculiar eczema is
quently observed, symmetrically occupying the sides of the thumb,
ex and middle fingers; this appears periodically every spring, and
appears during the warm weather of summer. Dry and scaly forms
eczema are frequently developed in the folds of the joints; and
ong the obese they assume the appearance of intertrigo. *About the*
l of the third decade of life, dyspepsia begins to torment the patient.
ere is flatulence, eructation, pyrosis, and constipation. The urine
omes highly charged with urates and uric acid. About this time
ritus and hæmorrhoids invade the rectum and the anal region. The
st exposure to chill now excites obstinate inflammations of the re-
ratory passages. Granular pharyngitis and suppurative tonsillitis are
quently observed, and the inflammatory process may extend through
Eustachian tube into the middle ear, producing chronic otitis with
its disagreeable consequences. Congestive headache and hemicrania
quently alternate with each other. Boils often occur. The hair
ows thin and falls from the scalp, and after a time the florid com-
xion gradually assumes an earthy discoloration as the liver becomes
raded by chronic functional disorders. Vertiginous attacks begin to
velop, and gradually become more severe. Asthma, nephritic colic,
d paroxysms of gastralgia now succeed one another as precursors of
ly developed gout. The brain suffers with the other organs of the
dy. Irritability, impatience, loss of memory, reduction of the power
consecutive thought, and cerebral exhaustion, add to the anxieties of
e patient. These vague and varied maladies often render life miser-
le for a considerable period of time before the final outbreak of the
uty paroxysm. This usually occurs during the latter part of winter,
ien all the unfavorable influences that render life difficult in a severe
rthern climate concur to exhaust the individual. The patient retires
bed, weary, chilly, and feverish. After a few hours of unquiet sleep,
out two or three o'clock in the morning, he is awakened by agonizing
in in the metatarso-phalangeal articulation of the great toe; the joint
pears swelled, red, shining, and hot. At the end of several hours of
quisite suffering, the pain subsides, and as morning approaches, sleep
omes again possible; a day of comparative comfort, is, however,
ceeded by another night of agony, since the pain now returns at an
ly hour in the evening, and continues until the following morning.
The *pulse* seldom rises above 100° F. *Fever* is continuous for about
days, and then gradually subsides. During the first two or three
s there is severe frontal headache; sometimes the patient is delirious
night; during the day he is irritable and nervous; the tongue is
ckly coated, and sometimes dry in its central portion and at the tip;
re is thirst, loss of appetite, constipation; scanty, high-colored, and
lding urine that throws down a copious sediment of uric acid and

urates; during violent attacks a little albumin may appear in the urine, but it disappears as the fever subsides; the skin is dry at first, but about the fourth night it becomes moistened by a gentle perspiration that differs from the profuse, sour-smelling perspiration of acute articular rheumatism.

During the *first attack of gout* the local manifestations are usually confined to a single one of the great toes, but during subsequent attacks both feet may be involved, and swelling appears in the joints of the tarsus, at the ankle, and in the knee. The joints of the upper extremities and of the spinal column are rarely involved. Pain generally subsides after the third day; the swelling diminishes; redness disappears; the skin becomes wrinkled, and desquamation occurs. Suppuration never takes place, but in chronic cases the joints become permanently enlarged by the persistence of œdema, and by the deposit of urate of sodium.

During the height of the febrile movement fine crepitant râles are sometimes heard at the base of the lungs.

The gouty paroxysm is efficient in the dislodgment and discharge from the tissues of an immense amount of *uric acid;* it is eliminated with the urine, and is present in the serum that exudes from blistered surfaces at a distance from the joints that are the seat of inflammation. If a blister be applied over such a joint, its serosity contains no uric acid. The increased oxidation that accompanies the fever serves to destroy and to expel uric acid and urates from the system. For this reason an acute attack of gout is usually followed by great improvement in the health of the patient, who often experiences for a time complete relief from the vague and sometimes obscure symptoms by which he had been previously tormented. An interesting example of this is related of the famous Lord Chatham (Lecky's *History of England in the Eighteenth Century*, vol. iii. pp. 133–156).

In old and ill-treated cases of gout, the paroxysms tend to recur more frequently; and finally the disease degenerates into *chronic gout*, in which there is no fever, and the joints remain permanently enlarged and œdematous. There is dull and continuous pain, which is never severe. Acute symptoms are entirely absent. Urate of sodium is abundantly deposited in the articular cartilages, and is accumulated in the circumjacent connective tissue, forming chalky concretions, known by the name of *tophi*. The joints gradually undergo disorganization, and the muscles, especially the extensors, become atrophied.

The imperfectly developed paroxysms of chronic gout do not afford the relief that is experienced after an attack of acute gout. During the intervals the subordinate symptoms of the arthritic diathesis, such as tonsillitis, inflammations of the respiratory tract, hæmorrhoids, urticaria, etc., are frequently renewed; and sometimes their occurrence is followed by temporary relief from the sufferings that are caused by latent gout. The abrupt suppression of such acute manifestations is often followed by great general disturbance, or even by sudden death.

Chronic gout exposes the patient to disease of the *circulatory apparatus* and of the *kidney*. The arterial structures are liable to inflammation, producing obstruction of the circulation, angina pectoris, and

gangrene. The *heart* is exposed to fatty degeneration, with stag-
on of the blood as a consequence. *Renal disease* frequently accom-
ies the changes in the arterial system, and is followed by hyper-
hy and dilatation of the heart, pulmonary œdema, bronchitis, and
mia. In many cases rheumatism and gout are united in the same
ject.

Uric acid exists in excess in the blood in both chronic and acute
ns of the disease; it is especially abundant during the paroxysm;
ay also be recovered from the lymph and serous fluids of the body,
it is also present in many of the tissues; from the blood or serum
a blister it may be readily obtained by the method of Garrod; if a
chm of the serum be placed in a watch-crystal and acidified by the
lition of six drops of ordinary acetic acid, crystals of uric acid will
deposited upon filaments teased out of a piece of thread, and dipped
the liquid for twenty-four hours; the crystals thus deposited may be
dily recognized by the aid of the microscope.

The fibrin of the blood is not diminished in acute cases. Sometimes
ces of oxalic acid are present as a consequence of decomposition of
c acid.

Though an excess of uric acid is usually present in the blood, this
not uniformly the fact, and sometimes it may be redundant without
y manifestations of gout; in the majority of such cases, however,
ier symptoms of the arthritic diathesis may be recognized.

It was formerly thought that free uric acid or its salts were always
esent in excess in the urine of a gouty patient; this, however, has
en shown to be an erroneous opinion. Garrod was led by his obser-
tions to entertain the belief that uric acid is diminished in the urine
t increased in the blood in all forms of gout. Later investigations,
wever, have shown that the urine contains uric acid or its salts in
antity equal to or greater than the normal amount, except in certain
ronic cases with interstitial nephritis, where the kidney is incapable of
minating the waste of the tissues.

The amount of *urea* in the urine is controlled by the appetite of the
tient, and by the quality of his food. The *phosphates* are increased
diminished in a manner that corresponds with the changes that
aracterize the elimination of uric acid.

In all forms of gout, and in the majority of arthritic subjects, the
ine exhibits a constant excess of acid. An excessive amount of
ate of sodium is held in solution by the acid phosphate of sodium.
e *blood* contains an inordinate amount of acid that favors the deposit
urates. These accumulate about the joints, and by their chronic
itation of the circulatory apparatus and connective tissues of the
ferent organs occasion the development of sclerosis, and other morbid
nges in the heart, liver, kidneys, and elsewhere.

An intimate connection between *lead poisoning* and the occurrence
gout has been noted by many observers. It is true that lead poison-
and gout may both depend upon the indulgence of the same habits;
ness the fate of chronic beer-drinkers who have been poisoned with
d from the pipes through which beer was drawn for the gratification
an inordinate appetite for alcoholic beverages. It has, moreover,

been ascertained that the presence of lead retards the elimination of uric acid; it also hinders the molecular changes that depend upon oxidation within the tissues. Lead poisoning thus favors the accumulation of uric acid in the system.

Saturnine gout generally occurs in anæmic and cachectic patients. It rapidly invades many of the joints, and tends to degenerate into the subacute and chronic form of the disease; and, though the extremities exhibit a characteristic degree of œdematous swelling, tophi rarely form about the joints or in the structures of the external ear. The kidneys and other internal organs, on the contrary, undergo rapid degeneration. Dropsy and uræmia are rapidly developed.

PATHOLOGICAL ANATOMY. The *deformities* that mark the disorganization of the small joints, in cases of aggravated gout, are well known, and cannot escape recognition. But in *minor forms of the disease* the diarthrodial cartilages exhibit streaks of a dull-white color beneath the articular surface, where urate of sodium is deposited in the substance of the cartilage. These deposits gradually coalesce, and finally reach the surface, where they destroy the smoothness of the superficial cartilaginous layer. The process of erosion progresses, and the capsule of the joint becomes infiltrated with urate of sodium until the entire articulation is destroyed and buried in the centre of a chalky concretion. This process is most commonly experienced in the small joints of the hands and feet, especially in those articulations that have been the seat of frequent gouty inflammation. The larger joints of the body usually escape, or are only invaded at a late period in the course of the disease. The process of infiltration commences at the centre of the articular cartilage, and is most conspicuous wherever the circulation of the blood is least abundant, or more easily retarded. For this reason the ligaments and other points of attachment are invaded at an early period. It is less common to find the synovial membranes infiltrated; and in their substance, also, the deposit commences where the circulation is least abundant. The synovial fluid does not exhibit any marked change, except in very chronic cases, when it appears turbid, and shows an acid reaction.

The period of infiltration is not marked by inflammatory symptoms, but after the deposit of urates has reached an amount sufficient to irritate the tissues, *secondary inflammation* may be set up, which adds greatly to the enlargement and deformity of the diseased joint. In this way the articular surface undergoes ulceration, and the joint cavity becomes filled with a chalky mass of semi-fluid consistency, in which are sometimes found blood corpuscles and pus cells. These changes are especially common in the larger joints. The smaller joints frequently become anchylosed and immovable.

Microscopical examination of the tissues in a gouty joint indicates that the infiltration of urate of sodium commences in the chondroplastic cells of the cartilage, and that the intercellular substance is invaded at a later period. Certain observers are of the opinion that infiltration occurs indiscriminately wherever the vitality of the cartilage has been sufficiently reduced by the excessive presence of urate of sodium in the nutritious fluids of the part. All, however, are agreed

at the inflammatory processes by which the cartilages are softened d destroyed are of a secondary character, dependent upon previous filtration of the tissue. The same successive changes may be noted in e non-cartilaginous structures of the articular capsule and ligaments. Outside of the joints the deposit of urate of sodium takes place at rtain points, where the accumulated masses constitute the concretions signated by the name *tophus*. These tophi are formed in the neighrhood of the small joints of the hands and feet, in the sheaths of the xors of the fingers, of the tendon of Achilles, in the lateral peroneal uscles, in the bursæ of the great toe, metacarpal bones, olecranon, tella, and os calcis. Inflammation of these bursæ may lead to supuration, with the formation of fistulous openings that communicate ith the neighboring joints. Subcutaneous deposits of urate of dium may exist at different points upon the surface of the body. The vorite seat of such deposit is in the auricle of the external ear, where unded nodules of the size of a mustard-seed, or larger, may be disvered along the border of the helix, or between the helix and antielix, or upon the inner surface of the auricle. Similar concretions ften exist in the eyelids, and in the alæ nasi, along the ulnar surface f the forearm, upon the palmar surface of the fingers, and upon the ternal aspect of the tibia. The superjacent skin sometimes becomes lcerated and cicatrized.

The *kidney* is, of all the internal organs, the one most liable to disorganization from gout. The gouty kidney is contracted; its capsule is hickened and cannot be stripped off without tearing away portions of he subjacent tissue; the connective tissue is thick and retracted, giving to the surface of the organ a roughened appearance; numerous mall cysts are also visible in its substance. The cortical portion is educed in thickness; the zone that contains the tubules is somewhat trophied, and the pyramidal vessels are considerably congested. Microscopical examination reveals typical interstitial inflammation of he kidney. The parenchymatous structures of the kidney are consequently subjected to pressure and considerable atrophy, though the pithelium of the uriniferous tubules in the pyramidal portion is usually ormal. In the cortical portion of the organ numerous cysts are rmed by the obstruction and dilatation of the uriniferous tubules. hese cavities contain a mixture of urine and urate of sodium. Sometimes, however, the kidneys, in well-marked cases of gout, with infiltration of the joints and advanced interstitial nephritis, are, nevertheless, entirely free from any deposit of uric acid or urate of sodium. Amyloid degeneration of the parenchyma is occasionally observed.

The *heart* is frequently hypertrophied, as a consequence of the same auses that produce changes in the kidney. Sometimes dilatation of he cavities of the heart, and fatty degeneration of its muscular fibres, ccur. Occasionally deposits of urate of sodium are found upon the alves, but they are of rare occurrence, and must not be confounded ith atheromatous deposits which occur in connection with general rterio-sclerosis. Atheromatous degeneration is almost universal mong gouty subjects, and it is the cause of many of the visceral sions that are developed in advanced cases of the disease. The fre-

quent occurrence of cerebral hemorrhage or softening, and the incidence of angina pectoris, as a consequence of obstruction of the coronary arteries, illustrate the serious consequences that follow this form of degeneration in the organs of circulation. The same predisposition on the part of arthritic patients is illustrated by the frequent occurrence of varicose veins, hæmorrhoidal tumefactions, œdema, purpura, etc.

In the *respiratory tract* concretions of urate of sodium are sometimes found in the cartilages and ligaments of the larynx, and in the similar structures of the bronchial tubes. To the irritation caused by the presence of urates in the concretions of the respiratory mucous membrane may be ascribed the frequent occurrence of catarrhal inflammation, pulmonary congestion, asthma, emphysema, and other respiratory disorders.

In the *alimentary canal* and its *appendages*, dilatation of the stomach and catarrhal inflammation are of frequent occurrence. It is seldom that any specific lesions can be discovered in the gastro-intestinal canal other than those that may be occasioned by over-eating, by the abuse of medicinal remedies, or by uræmia. The *liver* is frequently in a condition of temporary hyperæmia, but its permanent disorganization only occurs after the development of renal and cardiac disease. Fatty liver is a common accompaniment of the obesity that sometimes accompanies gout. The intemperate habits and consequent gastro-intestinal lesions that are frequently observed among gouty patients afford sufficient explanation of the tendency to cirrhosis; though many pathologists are of the opinion that gout does create a notable predisposition to that form of hepatic disease.

In the *nervous system* such lesions as exist are usually of a secondary character, presenting nothing of a specific nature. Occasionally deposits of urate of sodium or of uric acid have been found in the membranes of the brain and spinal cord, and in the neurilemma of the peripheral nerves. It is easy to imagine the possibility of consecutive inflammation secondary to such concretions.

Diagnosis. *Acute gout* is easily recognized, and the *chronic form* of the disease cannot be mistaken when the joints have become enlarged and disorganized. The occurrence of deposits in the cartilages of the ears, nose, larynx, and elsewhere, greatly aid the diagnosis. In doubtful cases the discovery of uric acid in the serous fluid of a blister is sufficient to establish the diagnosis of gout. In the absence of external manifestations of the disease, the recognition of visceral gout is often attended with considerable difficulty, unless the above method be employed.

Prognosis. The prognosis in gout is always a serious matter, since it is very doubtful whether the diathesis can ever be transformed; though it is possible by the exercise of sufficient care to avoid frequent recurrence of the acute manifestations of the disease. Chronic gout is hardly ever curable, and when the heart, kidneys, or other important organs have undergone degeneration, sudden death is not an uncommon occurrence.

Treatment. In cases that are marked by the existence of the arthritic diathesis, *prophylactic treatment* assumes the greatest impor-

ce. A mixed diet is desirable, but it must be enjoyed in moderation. lk forms one of the most useful articles of food. Wine, cider, and r should never be taken by those individuals in whom a gouty pre- position is manifest. Of these beverages, strong ale and porter are bably the most injurious. White wine and claret are less danger- s than Burgundy and other wines that are rich in tannin and sugar. undant exercise in the open air should be encouraged, but all ex- sive fatigue, both intellectual and physical, is to be avoided, since e paroxysm of gout is frequently provoked by exhausting efforts of y kind. A dry climate should always be preferred to damp and ld. Warm clothing, with flannel next to the skin, is desirable during e inclement seasons of the year. Every effort should be directed to e improvement of the cutaneous circulation by the use of sponge ths, flesh brushing, and massage. Even if it be impossible thus to ert the incidence of gouty phenomena, their severity may be greatly minished.

It is important to recognize the fact that every acute attack of ar- ular gout is in a certain sense beneficial to the patient. Violent ethods for its arrest or abridgment should be discouraged, in order to viate the dangers that accompany the occurrence of *retrocedent gout.* ith this purpose in view, the patient should be kept upon a low diet, t may be allowed to drink plentifully of cold water, lemonade, or any her agreeable beverage. Lithia water, Vichy water, and the solu- ons of granulated salts of potassium may be allowed *ad libitum.* The flamed joints should be placed at rest in an immovable position, and odyne lotions containing laudanum may be applied under an envelope cotton surrounded by oiled silk or thin rubber cloth. It is unneces- ry to administer saline cathartics until the subsidence of the fever. ain can be greatly relieved by the use of chloral hydrate, if the heart s not been weakened by previous attacks. Opiates must not be em- loyed. If the kidneys are not diseased, salicylate of sodium may be iven in doses of ten grains every hour or two, but it must not be ntinued for any length of time. As soon as the paroxysm of pain nd swelling subsides, the remedy should be discontinued. Great ele- ation of temperature may be reduced by the administration of fifteen rains of quinine. Vomiting, hiccough, and other gastric disturb- nces can be relieved by sucking ice, and by the application of mustard llowed by a hot poultice over the epigastrium. When thoracic com- lications exist, cups or leeches should be applied to the walls of the est.

Colchicum is an ancient and highly esteemed remedy that enters into e composition of the majority of anti-arthritic specifics. By its pre- ature employment there is a great risk of gastro-intestinal irritation, d the aborted paroxysm is liable to recur after a short interval of me. The best results are obtained by deferring the exhibition of the ug until the twelfth day of the attack; at that time it may be given doses of twenty drops of the tincture, two or three times a day. The medy should be used with great caution, and should be suspended as on as copious perspiration, diuresis, or diarrhœa occur.

After the conclusion of the gouty attack great benefit is derived from

the continued use of salicylate of sodium; it may be given for several weeks, to the amount of sixty or eighty grains a day. It augments the discharge of uric acid, and hinders the deposit of urate of sodium about the joints. Carbonate of potassium, and the bicarbonate of sodium produce similar good results. The sodium salt may be given to the amount of an ounce a day with only beneficial effects, except in cases of chronic atony and anæmia. Benzoic acid, the benzoates, and the salts of lithium, are also highly esteemed in the treatment of the disease. They are chiefly useful during the intervals between the attacks.

In all cases the function of digestion should be carefully supervised. Nux vomica, and other bitters, improve the appetite and aid the peristaltic movements of the gastro-intestinal tube. Rhubarb, sulphur, cream of tartar, and the mineral waters are the favorite laxatives. Naphthol and bismuth are valuable intestinal antiseptics. When the liver is hyperæmic, blue pill, or calomel in small doses, should be given daily for two or three weeks (Pil. hydrarg. mass., gr. j omn. nocte).

The natural mineral waters are useful in the treatment of gout. Springs that contain bicarbonate of sodium are useful in sthenic cases, while the sulphate of sodium waters are beneficial in cases of gastro-intestinal catarrh. When the disease principally involves the internal viscera the milder mineral waters containing weak solutions of bicarbonate of sodium and the sulphate or bicarbonate of calcium are to be preferred. Chronic affections of the joints are benefited by friction, massage, and electricity. When the function of digestion is not enfeebled, iodide of potassium is useful in doses of five to ten grains a day.

In cases of *retrocedent gout*, the treatment must be qualified according to the character of the symptoms and the condition of the organ that is invaded. The attempt should be made to recall the disease to the seat of its external manifestation by the application of mustard, or by blisters in the neighborhood of the affected joints.

CHAPTER VII.

NODULAR RHEUMATISM—ARTHRITIS DEFORMANS.

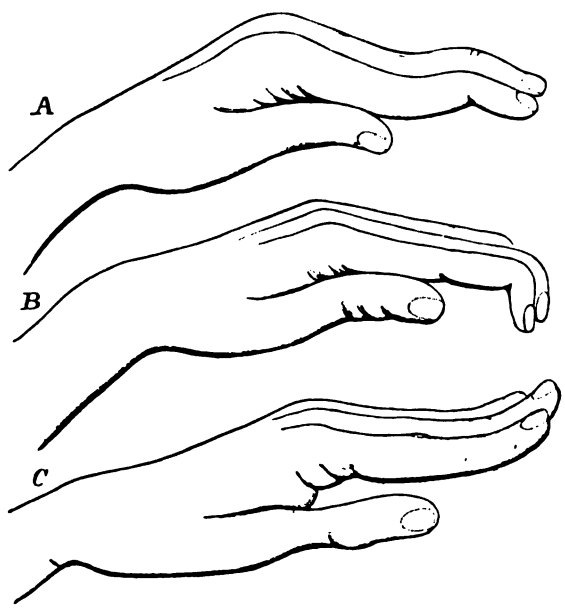
Symptoms. *Nodular rheumatism* is a chronic, progressive disease characterized by the existence of pain and the development of deformity in the joints. Commencing in the smaller articulations, and progressively invading the larger, its course somewhat resembles that of gout. The absence of uric acid and of the urates, gives to the disease a physiognomy approaching that of chronic rheumatism, hence the terms *rheumatic gout* and *rheumatoid arthritis* that have been applied to this form of joint disease. In certain cases, especially among old people, the disorder is limited to the hip-joint, hence the term *morbus coxæ*

ralis. But usually it is in the joints of the fingers and of the toes at it commences, advancing thence into the larger joints of the extremities of the body.

The *development of the disease* is accompanied by pain of a vague id general character, sometimes assuming the form of neuralgia or of mbness and formication, accompanied by a feeling of stiffness in the mbs. These uncomfortable sensations are frequently worse at night, id are often the cause of persistent insomnia. Gradually these pain-il sensations become concentrated about the articulations of the hands feet; the joints are slightly swelled, painful on pressure, and some-hat warmer than in health. Sometimes there is a slight discoloration f the skin.

An attack of this sort soon subsides, but is liable to frequent relapses. fter each paroxysm permanent traces of disorder remain, and at last ie evidences of disorganization are unmistakable. As the disease de-elops, painful muscular spasms, usually involving the flexor muscles, re experienced. These spasms add considerably to the sufferings of ie patient, and contribute largely to the deformation of the affected oints.

FIG. 126.

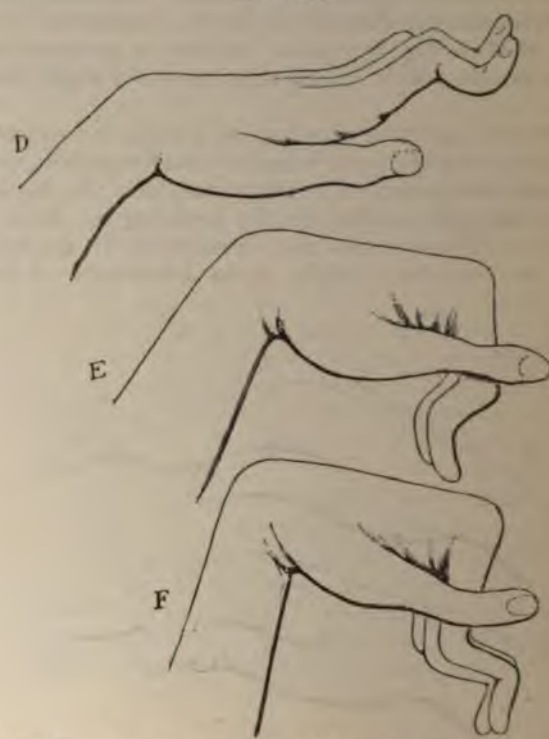


Types of deformity of the hand in rheumatoid arthritis. Type of flexion and its sub-varieties. (After CHARCOT.)

Articular deformity is due to subluxation of the joints by muscular ontracture, and also to chronic changes in the articular surfaces and eri-articular structures. The deformity of the fingers that is produced y muscular action is remarkably characteristic. When the action of ie flexor muscles is predominant, the distal phalanges are flexed Fig. 126), while the middle phalanges are forcibly extended, and the

proximal phalanges are flexed upon the metacarpal bones; the wrist is also in a state of flexion upon the forearm. In certain cases the third, fourth, and fifth fingers are laterally inclined towards the ulnar border of the hand. When the extensors are predominant, the distal and the proximal phalanges are inordinately extended, while the middle phalangeal bones are flexed in the opposite direction. (Fig. 127.)

FIG. 127.



Types of deformity of the hand in rheumatoid arthritis. Type of extension and its sub-varieties. (After CHARCOT.)

Upon the *feet*, the great toe is bent outward over the other toes so that its articulation with the first metacarpal bone is inconveniently prominent. The foot itself may assume the position of valgus, or of varus equinus. The lower extremity of the femur is rotated outwards so that its internal condyle projects beyond the surface of the tibia, while the patella stands over the external condyle, and the leg is flexed upon the thigh.

Sometimes the *spinal column* is also invaded, so that the mobility of its articulations is seriously impaired. The natural curvatures of the spine become exaggerated, producing considerable deformity.

As the disease advances the extremities of the bones become enlarged by the growth of *osteophytes* which surround the borders of the articular surfaces. This deformity is still further aggravated by the subluxa-

tion of the joints, by the atrophy of the neighboring muscles, and by the progressive thickening and induration of the peri-articular fibrous tissues. The *skin* in the neighborhood of the affected joints becomes thin, pale, covered with perspiration, and sometimes closely adherent to the subjacent tissues. Sometimes the integument is thickened, œdematous, and livid. The *nails* become thickened, incurved, grooved, and brittle. Sometimes they become detached and fall off without any apparent cause. In like manner the *hair* falls out. The *subcutaneous connective tissue* is atrophied, and the *aponeuroses*, especially the *palmar aponeurosis*, become thickened and contracted (Dupuytren's fingers).

It is worthy of note that when the disease develops in youthful subjects, the extremities are deformed and crippled by these different modes of contracture and subluxation, while among old people the principal cause of deformity lies in the development of osteophytes upon the extremities of the bones.

It is also important to note the fact that when the disease originates at an early period of life it is much more amenable to treatment than when its commencement is deferred until middle life or old age.

Occasionally *chronic diseases of the heart*, *pericardium*, and *aorta*, are associated with nodular rheumatism. Sometimes the cutaneous, nervous, and renal disorders that accompany the arthritic diathesis may be found coincident with nodular rheumatism. Not unfrequently such patients become tubercular, and succumb to chronic pulmonary disease.

The symmetrical character of the lesions, the systematic atrophy of the muscles, the progressive lesions of the bones, the fulgurant pains, the rapid palpitation of the heart, and the trophic changes in the skin that are observed in nodular rheumatism, so closely resemble the corresponding lesions that accompany dorsal tabes, hemiplegia, paralysis agitans, exophthalmic goitre, and other nervous disorders, that many pathologists incline to the belief that their common cause must be sought in the nervous system. With regard to the nature of that cause, if it exists, it must be admitted that little or nothing is known.

Pathological Anatomy. In all the varieties of senile arthritis and of nodular rheumatism the *articular lesions* are identical, though the extent of their evolution may vary. The *characteristic changes* consist in a villous condition of the articular cartilages, hypertrophy of the synovial fringes, and the growth of cartilaginous processes or osseous stalactites around the borders of the joints. Upon the articular surfaces the cartilage cells proliferate and become encapsulated. The superficial cells rupture and break down, while the subjacent capsules develop into villous processes, like the pile of velvet.

In *mild forms of the disease* there is little or no effusion about the joint, and the existing deformity is chiefly the result of atrophy of the muscles and peri-articular tissues. Sometimes the fibrous tissues around the joint become thickened and retracted so as to produce stiffness or partial dislocation of the articulation.

In severe and chronic forms of the disease, all the tissues that enter into the formation of the joint are involved. The synovial fringes become thickened, and finally are infiltrated with calcareous matter. The cells of the diarthrodial cartilages proliferate and undergo a villous

transformation. In this softened condition the articular surfaces are worn away until the subjacent bone is laid bare. The ends of the bones also undergo a process of eburnation by which they are rendered more resistant, though less adapted to freedom of motion. While this erosion goes on at the centre of the articular surface, the proliferating activity of the marginal structures results in an exaggeration of cellular growth, which, at first, consists in enlargement and swelling of the marginal portion of the articular cartilages. After a time the new growth becomes infiltrated with calcareous salts, and osteophytes are thus formed around the joint. Somewhat similar changes are manifested in the inter-articular ligaments and cartilages. In certain cases anyklosis is produced by the development of fibrous bands that bind the joint surfaces firmly together.

In many cases the bones become exceedingly friable through fatty degeneration of the marrow and absorption of the osseous framework of the bone.

In the knee and elbow joints the synovial fringes undergo cartilaginous transformation, and may become infiltrated with calcareous salts. The projecting filaments sometimes become detached, and accumulate within the cavity of the joint, where they exist as foreign bodies resembling in appearance grains of boiled rice.

The most *characteristic feature of chronic nodular rheumatism* is the deformity that is produced by the more or less complete destruction of the joints by the thickening and retraction of the adjacent fibrous tissues, by the development of ecchondroses and osteophytes, and by the dislocation that results from the irregular traction of the muscles that are connected with the articulations. Joints which, like the hip-joint, are not easily displaced by muscular action, present the least amount of luxation, and are the seat of the greatest degree of osseous growth. In addition to the changes that are thus directly produced, the deformities are aggravated and rendered more conspicuous by the results of chronic neuritis, and by the trophic changes in the skin and subjacent tissues which complicate the disease.

Etiology. *Chronic nodular rheumatism* occurs at all periods of life, but is most frequent between the ages of forty and sixty years. The disease is more common among women than among men, especially among the poor. It frequently accompanies *dysmenorrhœa* and rapidly successive *pregnancies*. When it thus attacks young women, it may be frequently cured, or may disappear spontaneously. It often develops at the time or *menopause*, and gradually increases in severity during the remainder of life. *Hereditary influences* are often conspicuous, but they are usually indicated by the existence of a *general arthritic predisposition*. Such patients are subject to frequent headaches, and chronic dyspepsia that is aggravated by the slightest departure from the ordinary habits of life. They are intolerant of alcohol, tobacco, tea, and coffee. If the liver and the kidneys or the skin become in any way hindered in the performance of their functions, a tendency to articular pain and disorder is at once manifested, as if the joints were in some way compelled to act the part of supplementary organs of elimination.

Exposure to dampness and cold is a common cause of the disease,

ecially when such exposure is continuous by reason of the occupa-
n or residence of the individual. Especially unfavorable is the
luence of cold when associated with privation and suffering. The
ease is far more common among the indigent than among the upper
sses. It is also often associated with *scrofula*, *pulmonary consump-
n* and *albuminuria;* and, like those maladies, appears to be the
sult of physical degradation. Its association with *gout* and with
eumatism is much less intimate. It also presents many points of
semblance to those *arthropathies of nervous origin* which are devel-
ed in connection with certain nervous diseases like tabes dorsalis,
miplegia, and paralysis agitans.

Nodular rheumatism is frequently excited by the *uterine disorders* females. *Menstrual disorders*, *frequent pregnancy*, and *prolonged ctation*, are often accompanied or followed by the development of the ticular disease.

DIAGNOSIS. *Arthritis deformans* is distinguished from *gout* by e absence of paroxysmal attacks, and by the fact that the disease anifests no predilection for the great toe. Urate of sodium is not eposited about the joints, and there is no accumulation of that sort nder the skin of the ear, elbow, or elsewhere. *Chronic articular heumatism* exhibits a higher degree of local inflammation. *Chronic ubercular joint diseases* sometimes resemble some of the features of odular rheumatism, but they do not produce the characteristic de-rmity of the articulations.

TREATMENT. A dry, warm climate is desirable for the subjects of odular rheumatism. Flannel should be worn next to the skin by day nd by night. When the power of digestion is sufficient, cod-liver oil useful. Iron should also be prescribed for young and anæmic pa-ents. Local friction of the joints with stimulating liniments promotes he circulation. Pain may be relieved by full doses of antipyrine or alol; salicylate of sodium is less successful. Chloral and phenacetine eldom afford much relief. Severe suffering can rarely be relieved ithout recourse to opiates. Small doses of the tincture of colchicum re sometimes beneficial. The remedy should be given for two weeks, en suspended for an equal length of time. In this way it may be lministered until the disappearance of pain. Carbonate of sodium, nd other alkaline salts, may be given in large doses for a long time ith great benefit; associated with quinine it may be given to the nount of an ounce a day.

When the acute symptoms of the disease have been subdued, the ost valuable remedies are iodine in combination with alkaline bases, nd arsenic. The compound tincture of iodine may be given at meal-ne, morning and evening. The dose should be gradually increased om five drops to half a drachm.

When arsenic is given, it should be administered in the form of owler's solution after meals; the dose may be increased from two to x drops; this drug frequently causes aggravation of the symptoms of e disease when it is first administered, but after a time tolerance is tablished, and improvement follows, except in aged patients and in-terate cases. The ammoniacal tincture of guaiac produces similar

effects. Warm baths containing arseniate and bicarbonate of sodium, have been recommended; it is, however, doubtful whether they produce any beneficial result that cannot be ascribed to the warmth of the water itself. At first the baths should be taken every other day; but the patient should remain warm in bed for an hour or two after each bath. If pain is aggravated by these baths, it may be relieved by the administration of a grain of the extract of conium, with Dover's powder at night, and the joints may be rubbed with an anodyne liniment.

R.—Tr. aconit. rad. }		
Tr. belladon. }		ää ʒij.
Tr. camphor.		℥ss.
Chloroform.		ʒj.
Lin. sapon.		℥vj.—M.

During such a course of treatment the patient should take from three to ten grains of iodide of potassium with the elixir of calisaya bark before each meal. After the subsidence of acute symptoms daily massage and frequent movements of the affected joints will be found beneficial. These exercises may be advantageously employed during the bath. At first the movements are painful, but their cautious repetition is attended finally with excellent results. It is usually necessary to prolong this treatment for a month at least. Even in those obstinate cases that are incurable, a great amount of temporary relief is usually obtained. A repetition of the treatment is desirable during the course of every spring and autumn. In many cases the Turkish bath is very beneficial, and the domestic method of sweating the patient over an alcohol-lamp is not to be despised. Seaside resorts and sea bathing are to be avoided. Hot mineral waters that contain chlorides, sulphur, and arsenic, are greatly to be preferred. In moderate forms of the disease warm mud baths are sometimes useful. The local application of iodine, blisters, and the actual cautery, is sometimes followed by relief. Daily massage is exceedingly useful as a means of preventing muscular atrophy, and of promoting the nutrition of the affected tissues. The galvanic current has been employed with moderate success. Large sponge electrodes should be used, placing the positive pole upon the spine, while the negative pole is applied to the affected part, either directly, or by communication with a warm bath in which the diseased extremities are placed. The current should be applied for ten or fifteen minutes every day, for a month; after that time, at longer intervals.

Of all the remedies above mentioned, the two most successful are iodine and warm baths.

CHAPTER VIII.

ACUTE RHEUMATISM—POLYARTHRITIS ACUTA.

Symptoms. *Acute rheumatism* usually commences quite abruptly, with a severe chill, or with repeated chilly sensations. Occasionally the disease begins with a feeling of general discomfort and transient

ins in the joints for two or three days before the outbreak of the
er. The *temperature* rapidly rises to 103° or 104° F., and it is
egular in its course. The *pulse* and *respiration* become more fre-
ent; the *tongue* is coated; appetite disappears; there is great thirst;
e *bowels* are confined; the *urine* is scanty, high colored, extremely
d, and sometimes contains a little albumin; it frequently deposits a
pious sediment of urates; the *skin* is covered with a copious acid
spiration which often occasions miliary eruptions upon the surface;
e red blood-corpuscles rapidly diminish, while the white corpuscles
e greatly increased in number.

Simultaneously with the commencement of the fever, one or more of
e *joints* in the lower extremities begin to swell and to become pain-
l; usually the larger joints are principally affected, but not unfre-
ently the articulations of the fingers and toes are invaded. It is
equently observed that inflammatory symptoms rapidly develop in a
int and as rapidly subside, only to reappear in some other joint.
ometimes nearly all of the joints of the body are invaded, either
multaneously or in rapid succession.

The occurrence of inflammation causes swelling and redness of the
in over the affected joint. The tissues are œdematous and pit on
ressure, since the swelling is caused chiefly by transudation into the
ubcutaneous areolar tissue rather than into the cavity of the articula-
on. Every form of movement is attended with intense suffering, so
at the victim of acute polyarthritis becomes as helpless as if he were
paralyzed. The limbs assume such positions as are attended with the
ast pain, and every attempt at movement is followed by great suffer-
ng. Sometimes painful motion occasions an audible creaking, which
s dependent upon inflammation of the fibrous capsule and tendinous
heath, rather than upon the actual changes within the articular
avity.

Acute rheumatism may subside spontaneously in a few days, or it
ay continue from four to twelve weeks, or longer. Partial recovery
s frequently followed by relapse. In such protracted cases febrile
ymptoms gradually subside, and all the phenomena tend to assume a
oderate degree of intensity. Convalescence is very gradually estab-
ished, and the patient remains pale and anæmic for a long period of
ime.

Certain forms of *masked rheumatism* may exist, in which the
isease involves, not the joints, but the nerves, especially the tri-
eminal nerve, producing severe neuralgia, sometimes associated with
ndocardial inflammation. In certain cases the pericardium, or the
ndocardium alone, undergoes inflammation, without intercurrent joint
isease or neuralgia. All these forms of rheumatism yield readily to
ie administration of salicylic acid.

Endocarditis is a very frequent complication of articular rheuma-
sm; sometimes it assumes the ulcerative form. *Pericarditis* is a less
ommon event. Occasionally *myocarditis* results from embolism of
ie cardiac arteries, or directly from the action of the original causes
f the disease.

Cerebral rheumatism sometimes occurs. This is usually accom-

panied by high fever, delirium, and stupor. It is a very fatal complication, and death is often preceded by an extraordinary elevation of temperature, which sometimes reaches 110° F. In certain cases the symptoms closely counterfeit those of meningitis. Genuine inflammatory exudation, however, is rarely discovered after death. Sometimes paralysis and other cerebral symptoms are induced by the occurrence of embolic obstruction in the cerebral arteries. When severe inflammation of the kidneys accompanies the evolution of rheumatism, uræmic intoxication sometimes occurs.

Occasionally the articular inflammation results in *suppuration* and destruction of the joints. Sometimes the *sheaths of the tendons* become enlarged by the growth of painful excrescences that consist of connective tissue and fibro-cartilage. These growths, which are usually observed among children, gradually disappear; but sometimes they persist for a long time, and occasion contracture of the affected tendons. *Abscesses* in the muscles are sometimes observed. Various *eruptions* upon the skin are not uncommon. Among these may be specified roseola, urticaria, erythema, herpes, erysipelas, purpura, and bullous vesicles or pustules. Sometimes little *nodular tumors* may be discovered under the skin over the forehead and occiput, and elsewhere. Occasionally the veins become obstructed by *thrombi*. Rheumatic *inflammation of the iris* and *paralysis* of the *oculo-motor nerves* have been observed. *Catarrhal affections* of the *respiratory mucous membranes* are not uncommon. Sometimes *pleurisy*, *pneumonia*, and *peritonitis* may exist as complications of the disease. Acute inflammation of the *kidneys*, *cystitis*, and *urethritis*, have been already described. *Hæmaturia* may exist as a consequence of renal embolism, or of the excessive use of salicylic acid, so that it is not always an indication of acute nephritis.

It is evident from this review of the possible complications that many subsequent diseases and disorders may follow the occurrence of acute rheumatism. Sometimes *ankylosis* of the joints remains, and is followed by rapid muscular atrophy. The *spinal cord* may be invaded by the disease, producing paraplegia, and paralysis of the bladder. Other paralytic affections may result from *cerebral lesion*, or from *peripheral neuritis*. *Valvular diseases* of the *heart* are not uncommon sequelæ of the disease. *Chronic nephritis*, *chorea*, and *mental derangement* must be enumerated among the permanent consequences that occasionally follow acute rheumatism.

Pathological Anatomy. Since only about three per cent. of the cases of acute rheumatism prove fatal, comparatively little is known regarding the pathological changes that accompany the disease. *Capillary hemorrhages* have been observed in the mediastinum and under the serous membranes of the heart, pleural cavity, peritoneum, and meninges. Similar effusions occur in the spleen, heart, liver, and kidneys. The *spleen* is enlarged and soft. The *cardiac muscles* are relaxed, and exhibit the appearances of cloudy swelling and granular degeneration. The *joints* usually contain but little fluid; sometimes, however, they are occupied by a turbid, flocculent, and sometimes purulent effusion. The synovial membranes and the articular cartilages are congested. The synovial fringes are swollen, and the cartilages

hibit proliferation of the capsules and cartilage cells. Occasionally rinous adhesions exist between the ends of the bones, and sometimes ere is some degree of erosion involving the articular cartilages.

ETIOLOGY. Nothing certain has yet been ascertained regarding the timate cause of acute rheumatism. It is usually ascribed to the results of exposure to cold and damp; this, however, is only giving ominence to an exciting cause. Many facts may be urged in favor of parasitic origin of the disease, though the presence of a specific microganism has never been demonstrated. Staphylococcus pyogenes reus has been discovered in the exudations of rheumatism, but there no satisfactory evidence to prove that this particular microörganism the contagious agent. Still, the quasi-epidemic occurrence of rheumatism, its connection with particular localities and houses, its evident lation with cold and dampness which favor the occurrence of other fective diseases, the febrile character of its course, the enlargement of e spleen, and the tendency to capillary hemorrhages that is observed hen opportunity is afforded for examination of the tissues after death, l indicate a most intimate relationship with other infective disease.

The influence of *cold*, especially when acting upon the overheated d perspiring body, cannot be questioned. Sudden refrigeration under ch circumstances is a most efficient exciting cause when the rheumatic redisposition has been already established. For the same reason exssive physical and mental *fatigue* favors the onset of the disease. *Injuries*, especially those which involve the joints by twisting or straining the articular ligaments frequently cause a determination of rheumatic flammation to the injured locality. *Heredity* is frequently assigned s a cause of rheumatism. There is, however, no direct transmission of he disease. It is possible that a hereditary lack of resistance may be ransmitted. The influence of *sex* and of *occupation* produces comaratively little effect upon the distribution of the disease. Its articular orms are most frequently observed during the first fifteen years of dult life. In childhood, and in more advanced life, masked forms of he disease are more common.

Previous experience of the disease operates as a predisposing cause r its return. The more frequently it recurs the more often it is liable relapse, until it finally becomes merged into the form of chronic heumatism.

DIAGNOSIS. Simple, *acute rheumatism* is easily recognized, but its mplications may escape notice for a time, unless the precaution be bserved to make frequent examination of the heart and other organs the body. The articular disease must be differentiated from those *cute inflammatory conditions of the joints* which sometimes accompany follow other infective diseases, such as pyæmia, puerperal fever, phtheria, syphilis, gonorrhœa, etc. The acute attack of *gout* usually vades the joint of the great toe, and there is a greater degree of nous dilatation in the neighborhood of the affected articulations. Exliation of the epidermis is more commonly observed in gout than in heumatism. The fever of gout is less continuous than that of rheumatism; the amount of perspiration is less copious, and it does not ossess the peculiar sour smell that characterizes the rheumatic sweat.

PROGNOSIS. The immediate prognosis is almost always favorable in acute rheumatism, since the mortality does not exceed three per cent. Complications involving the heart, the lungs, and the brain, add greatly to its dangers, and the after-effects that follow endocarditis, nephritis, and other internal complications, are often attended with great danger.

TREATMENT. During the acute stage of rheumatism the diet should consist chiefly of liquids. Cold water and lemonade may be given freely. Good ventilation is needed, but an even temperature of 65° to 70° F. is desirable. The patient should be clothed in a flannel night-dress, and should lie between blankets or flannel sheets.

It was formerly the custom to administer alkaline salts in large doses, until the urine became neutral or slightly alkaline. Dover's powder was necessary to relieve the suffering of the patient; but at present these remedies have been almost entirely superseded by salicylic acid and its salts. These remedies should be given in doses of ten grains every hour, until a distinct humming or buzzing is audible in the ears. The drug may be then suspended for two or three hours; and then renewed hourly until the same experience is repeated. Thorough saturation of the blood with the medicine is quickly followed, in the majority of instances, by relief from pain and subsidence of the swelling. The more acute the inflammatory symptoms, the greater the degree of relief. As the febrile and painful condition disappears the remedy may be given less frequently, once in three, four, five, or six hours, but it must not be wholly discontinued until a week or ten days have elapsed, otherwise a relapse may be anticipated. The occurrence of endocardial inflammation need not prevent the administration of salicylic acid, but more care should be exercised to avert any tendency to heart failure.

When salicylic acid and its compounds cannot be longer tolerated by the stomach, salol is frequently efficient. This may be given in doses of ten or fifteen grains every two hours until the subsidence of fever and swelling. The dose may then be given at longer intervals. It is worthy of note that other febrifuge remedies, like antipyrine, in fifteen-grain doses every three or four hours, produce similar results, though by no means as reliable agents as salicylic acid. Occasionally, however, one of them will produce a better effect than the acid.

If in spite of this active medication, painful swelling persists, much benefit is often obtained from hot fomentations, frequently renewed, upon the affected joint. Sometimes great relief is afforded by fixation of a large joint by the application of a plaster-of-Paris splint. Continuous pressure, however, is liable to be followed by muscular atrophy, requiring the continued use of the faradic current for its cure.

In certain cases of rheumatic arthritis which resist other forms of treatment, rapid relief is obtained from the administration of the tincture of colchicum seeds, given in doses of ten drops three or four times a day. Associated with full doses of the tincture of aconite root, it sometimes is followed by most satisfactory results. It is probable that in these cases a gouty predisposition actually exists.

Since the depression of temperature by any method is usually followed by relief in rheumatic inflammation, considerable benefit is often

tained by other remedies that diminish the liberation of heat within e body. For this reason relief is sometimes procured by the administration of fifteen-grain doses of quinine or salacine.

Certain cases of rheumatism will, nevertheless, be found intractable by any of the measures above recommended. The application of cantharides plasters to the affected joint is, under such circumstances, frequently followed by prompt and effectual relief. Lingering cases that have dragged along for many days or weeks, without benefit from other treatment, sometimes experience such release from pain as soon as the blister begins to draw that they eagerly call for its repetition whenever and wherever the articular inflammation manifests itself.

During the subsidence of the disease, and in subacute cases that manifest a tendency to chronic duration, considerable improvement frequently follows the use of chloroform liniment, or the application of turpentine. Strong tincture of capsicum is also of considerable service as a local application. The resulting improvement is principally due to the quickened circulation of blood in the affected parts.

During the later stages of a protracted case of rheumatism, when the blood has become impoverished, iodides and iron are useful. The syrup of the iodide of iron, in half-drachm doses every four hours, often affords great benefit.

The occurrence of cerebral symptoms and an unusual elevation of the temperature require the active employment of phenacetine, acetanilide, or antipyrine, in full doses. Moderately warm baths, in which the patient should lie for an hour at a time, may be employed with considerable hope of advantage.

Chronic Rheumatism—Polyarthritis Chronica.

ETIOLOGY. *Chronic rheumatism* is generally experienced after the middle period of life. It is sometimes the result of an acute attack which partially subsides and degenerates into a subacute, persistent, and sometimes permanent articular inflammation. In many cases, however, it originates as a subacute and chronic inflammation without any very acute or conspicuously inflammatory symptoms. It is frequently excited by exposure to cold, and by a residence in damp and unwholesome apartments.

SYMPTOMS. The disease runs its course without fever, though sometimes exacerbations may occur, which are accompanied by a febrile movement that, for the time being, suggests a moderate paroxysm of acute rheumatism. The *heart* and other internal viscera, however, very rarely manifest any tendency to participation in the disease. The *larger joints of the extremities* are the favorite localities for its manifestation. Sometimes the smaller joints of the hand and foot are also invaded. Occasionally a moderate degree of swelling and slight redness of the skin about the affected joint may be observed, but in the majority of cases these symptoms are absent, and the disease is indicated by the occurrence of *pain* in the articulations. This may be felt more or less continuously, or it may be experienced only on pressure over the joint, or during the act of moving the limb. After a time

there is thickening of the articular capsule and other adjacent fibrous tissues, so that a certain amount of creaking may be heard when the joint is flexed and extended. In old cases, more or less complete anchylosis may be developed, accompanied by chronic enlargement and deformity of the affected joints, which, however, do not exhibit the characteristic subluxation and deformity that characterize *arthritis deformans*. Rapid muscular atrophy, involving the muscles on the proximal side of the joint, is not unfrequently observed.

The *duration* of chronic rheumatism is exceedingly tedious. It frequently becomes a life-long disease, crippling the patient and rendering him uncommonly sensitive to changes of the weather. These premonitions of approaching atmospheric disturbance appear to be connected with the variations of barometric pressure that precede the coming of an extended rainfall or other cyclonic commotion.

PATHOLOGICAL ANATOMY. The principal pathological changes in chronic rheumatism involve the *articular capsule*, its *synovial lining*, the *synovial fringes*, and the *diarthrodial cartilages*. The synovial fluid is very scanty in amount; the synovial fringes become thickened; the cartilage cells proliferate and then undergo degeneration and absorption, thus producing erosion of the joint surfaces. Sometimes fibrous bands are thrown across the space between the ends of the bones, causing anchylosis, and more or less obliteration of the articular cavity.

DIAGNOSIS. *Chronic rheumatism* may be readily distinguished from *gout* by its gradual development, by the absence of uric acid from the blood, and by the fact that mineral concretions never form around the joints or beneath the skin. The earlier paroxysms of gout usually attack the great toe joint, for which chronic rheumatism seldom manifests any partiality. It is more difficult to distinguish between old cases of chronic rheumatism and *arthritis deformans*, but the rheumatic disease is frequently preceded by one or more attacks of acute rheumatism, and the articular deformity exhibits a more decidedly inflammatory origin, course, and history, than is observed in arthritis deformans.

PROGNOSIS. So far as a fatal termination is concerned, the prognosis is exceedingly favorable; but the duration of the disease cannot be foreseen; and the degree of incapacity for the enjoyment of life and its active occupations is beyond any possibility of estimation.

TREATMENT. The remedies that are useful in the treatment of acute rheumatism will be found of service in the chronic disease; but their effects are less rapidly manifested, and are much more uncertain in their development. Iodide of potassium, colchicum, and aconite should be administered after the exhibition of salicylic acid and its congeners. The local use of liniments and strong tincture of iodine sometimes affords relief. Powdered gum guaiac, in doses of five grains every four hours, and the ammoniated tincture of guaiac (one drachm, in milk, three or four times a day), sometimes operate beneficially. Hot brine baths repeated every day for a month or six weeks, often prove very effectual, especially when associated with active manipulation of the muscles by massage, together with judicious movement of the affected joints while in the bath. Turkish baths, sulphur baths, and hot mud

ths, are sometimes followed by good results. The internal adminis-
ation of sulphur mineral water, or small doses of lac sulphur are
nd beneficial.

R.—Lac sulphur gr. v.
Potass. bitartrat. gr. j.
Sacch. lact. gr. x.—M.

The old-fashioned "Chelsea Pensioner" owed its reputation in the
eatment of chronic rheumatism among the worn-out pensioners of the
ritish navy to the sulphur, cream of tartar, and guaiac that it con-
ined.

Active counter-irritation with the faradic current and the electric
rush sometimes affords relief, but it is a remedy of less efficacy than
assage associated with the use of stimulating liniments and other
ritant applications, unless the muscles have undergone atrophy.

Muscular Rheumatism—Rheumatismus Musculorum.

ETIOLOGY. *Muscular rheumatism* is not uncommon among children
nd young people, but it is more frequently observed after the middle
eriod of adult life. It is often experienced by successive generations
n the same family line. Its most common exciting cause is exposure
o wet and cold, especially during perspiration. Unilateral refrigeration
y sitting before an open window, or standing in a strong draught of
ool damp air, is a very common means of exciting the disease.

PATHOLOGICAL ANATOMY. Since muscular rheumatism never proves
atal, nothing is known regarding the pathological changes that accom-
any its course. Its affinity with other forms of rheumatism suggests
he possibility of an infective cause, either from without, or originating
y a process of auto-infection. The seat of the disease is in the fibrous
onnective tissues of the muscles. In severe cases it is probably accom-
anied by transient inflammatory processes which, however, are ex-
edingly evanescent and migratory.

SYMPTOMS. The cardinal symptom of muscular rheumatism is a
ainful condition of the affected muscle. This may be either constant,
aroxysmal, or evoked by local pressure. The local manifestation is
ubject to great variability, and frequently shifts its seat from one mus-
ular mass to another, without any apparent cause. This migratory
haracter is chiefly displayed by the minor forms of the disorder.
evere attacks of the disease frequently exhibit a degree of local per-
stence rivalling that of chronic articular rheumatism. In such cases
ight fever is frequently present, and there may be a moderate eleva-
on of the temperature. In the majority of cases the disease is
naccompanied by any febrile movement, and the patient continues in
s daily avocation, though frequently subjected to considerable incon-
nience and suffering in the use of the affected muscles. No part of
e muscular apparatus of the body is exempt from the disease. It is
ten a source of considerable pain connected with the movements of
e eyeballs, or other movable portions of the head, face, throat, and
ck which are particularly exposed to the influence of cold. When

the disease is presented by the muscles that support the
In severe forms, involving the cervical region, the head
and drawn to one side (rheumatic torticollis). In m
laryngeal muscles and the bronchial mucous membrane
the disease, producing a *harassing cough* that may pe
months. Complete and sudden relief from this symptom
the migration of rheumatic symptoms to the external
the body and extremities. *Irritation of the cardiac*
in like manner produced, occasioning irregular and unus
of that organ. The *œsophageal*, *gastric*, and *intestinal*
are also sometimes invaded, producing temporary pai
that are characterized by uneasiness, or even by pain
severity, during the peristaltic contractions of the alime
like manner the muscles of the *perineum*, *rectum*, *an*
become temporarily painful, when subjected to unusu
contraction during the acts of defecation, micturition, a

Like other forms of rheumatism, the muscular disease
acute or chronic. Acute attacks are often very brie
readily relieved, but the chronic form may persist
months together. With advancing age the disease beco
erate, so that many elderly people suffer exceedingly du
months of the year from this cause. Sometimes the co
of the affected muscles becomes permanently thickened
producing a certain amount of local deformity. Sometim
and myocarditis become associated with muscular rheum

DIAGNOSIS. The disease may be readily recognized
of the patient, who soon learns to understand the natur
toms, and to refer them to their appropriate cause. A
muscles in which they are painful without previous inju
be ascribed to anything else. When the muscles of the

vement of the bowels, and to stimulate the kidneys by the judicious e of diuretics. Sulphur and cream of tartar, dilute nitric acid, ute phosphoric acid, citrate of potassium, and the salts of lithium are ong the most efficient agents for this purpose.

CHAPTER IX.

ALCOHOLISM.

Alcoholism signifies that condition which is produced by the introaction of alcohol into the tissues. It is a mode of intoxication ite similar to that by which ptomaïnes and other products of bacrial activity produce their effects upon the animal organism. In fact, cohol is itself a product of bacterial growth. It exists in all liquids at have undergone fermentation, *e. g.*, beer, wine, and the products of eir distillation. The quality of these alcoholic beverages varies eatly, and the effects which they produce are correspondingly various. he least dangerous are those which contain ethyl alcohol unmixed th other essences, alcohols, and ethers. For this reason good natural nes and beer are less deleterious than cordials, essences, brandies, hiskies, etc., that have been fortified and flavored to suit the palate of rdened drunkards.

Alcoholism is more frequent and more severe in northern countries ere the population are given to the use of distilled liquors. It is less mmon and less severe in southern countries where wine is drank ; but ong tropical savages who consume distilled spirits, the evil effects of cohol are most conspicuous.

The susceptibility to alcoholism varies greatly with different indiduals. Much depends upon the original constitution. It is more ngerous among persons of delicate and nervous organization, while dividuals of a coarse and vigorous fibre, who lead an active life, may g withstand the deleterious influences of the poison. Hereditary inences not unfrequently determine an appetite for alcoholic beverages, d the predisposition to drunkenness may be transmitted from generan to generation. In certain cases there is apparently a morbid preposition to paroxysmal exhibitions of drunkenness, constituting what termed *dipsomania*. These cases are closely allied with insanity, d constitute a special morbid entity. During the outbreak of a paysm of dipsomania, the patient intoxicates himself in a genuinely sane and irresponsible manner, and should be restrained like any ner maniac.

Alcoholism may occur as a transient event in the life of a healthy d temperate person. This constitutes *acute alcoholism*. It may also come a confirmed disease of the entire body as a consequence of the g-continued abuse of alcoholic beverages. This condition is termed *ronic alcoholism*.

Acute Alcoholism. This form of the disease presents itself as a fit of intoxication consequent upon a single indulgence. It is characterized by an introductory stage of excitement in which all the functions of the body are temporarily increased, but are soon merged in disorder that terminates in the collapse and stupor of complete drunkenness. The effects of such a debauch usually disappear in the course of a few hours. The patient awakens with a headache, feels dull and incapable of active intellectual exertion, but in the course of a day or two of abstinence the normal activities of the brain and nervous system are fully resumed.

In *severer forms of the disease* the mucous membranes of the alimentary canal become moderately inflamed, and the liver is irritated by the passage of blood containing alcohol through its capillaries. The symptoms are identical with those of ordinary catarrhal gastritis. There is a sense of uneasiness in the region of the stomach, loss of appetite, great thirst, nausea, sometimes vomiting and diarrhœa. In severe cases a moderate degree of jaundice makes its appearance. The tongue is flabby and covered with a pasty coating indicative of the extensive disorder of the digestive tract. These symptoms gradually subside, and recovery is reached in the course of a week or ten days. In warm climates, however, the liver may become severely inflamed, and sometimes suppuration may occur within its substance.

In the *severest forms of acute alcoholism*, death frequently results from the profound effect of alcohol upon the brain and nervous system. Such accidents are usually witnessed among young children who have accidentally drank an excessive quantity of spirits, or among drunkards who undertake to swallow a bottle of brandy for a wager. The victim soon passes into a state of profound unconsciousness that is sometimes interrupted by convulsive movements. Respiration is stertorous, and soon becomes embarrassed by the failure of the respiratory muscles and the excessive accumulation of mucus in the trachea. Death occurs sometimes in less than an hour, though life may be prolonged for fifteen or twenty hours.

After death alcohol is found free in the blood and in the viscera. The mucous membrane of the stomach and intestines exhibits a high degree of congestion accompanied by an abundant hemorrhagic infiltration of the tissues. The membranes of the brain are intensely congested, and capillary hemorrhages cover the surfaces of the cerebral convolutions.

Chronic Alcoholism is the result of the long-continued habitual use of alcoholic beverages. The persistent though temperate use of them produces results more serious than the consequences of an occasional debauch. Few habitual drunkards escape damage in some part of their structure, but the stomach and the liver are the first to suffer, since they bear the brunt of the attack.

The breath of chronic alcoholism possesses a peculiar, characteristic odor. The *mucous membrane of the mouth* is red and irritated. The *tongue* is covered with a thin white coating, and the organ is sometimes

ssured. The *pharynx* exhibits the red and roughened appearance hat is characteristic of granular pharyngitis. The mucous membrane f the *œsophagus* sometimes exhibits erosions, and its veins become aricose. The *lining of the stomach* is in a state of chronic inflammaion; in rare instances suppurative inflammation is observed; the organ tself is often relaxed and dilated, but in advanced stages of the disease he gastric walls are thickened and indurated. Sometimes irregular rosions and ulcerations occur in the mucous membranes. These are naller and more irregular in shape than the typical round ulcer of the tomach.

As a consequence of *chronic gastritis* the patient suffers with indigestion, loss of appetite, excessive thirst, nausea, and vomiting. In he majority of cases the act of vomiting occurs on arising in the morning. After retching and coughing and strangling for a time, a quantity f bitter, slimy fluid is ejected from the stomach and throat. It consists of the saliva and gastric refuse that has accumulated during the ight. Occasionally little streaks of blood are visible in the gastric mucus.

The *intestinal mucous membrane* exhibits symptoms of inflammation, but they are characterized by a lesser degree of severity than is observed in connection with the stomach.

The connective tissue of the *liver* indicates chronic inflammation and contraction, constituting ordinary *alcoholic cirrhosis*. The hepatic cells are compressed by the contracting connective tissue, and pass into a condition of fatty degeneration. Sometimes the liver becomes enlarged and fatty. In certain cases the effects of alcohol are evident in a distinct change of function in the hepatic cells, producing a severe form of icterus.

The inflammatory condition of the pharyngeal cavity frequently extends to the mucous membrane of the *larynx*, producing the hoarse and guttural speech that is so characteristic of ancient drunkards. It is often accompanied by a laryngeal cough.

Alcohol does not directly produce diseases of the *lungs*, but it seriously complicates the prognosis in all existing pulmonary diseases.

The nutrition of the *heart* is profoundly influenced by chronic alcoholism. The muscular substance frequently undergoes degeneration as a consequence of disease of the coronary arteries, and myocarditis is not uncommon. The arterial structures everywhere exhibit a tendency to atheromatous degeneration, and sometimes the portal vein becomes inflamed.

The *kidneys* are often invaded by interstitial nephritis, and there is in many cases a chronic venous congestion of the organs, constituting the "pig-back" kidney of alcoholism.

The *sexual functions* are profoundly modified; impotence and disturbances of menstruation are not uncommon. Abortion frequently occurs, and the offspring of drunken parents are frequently epileptic, idiotic, or insane.

Meningeal hemorrhage is not an uncommon event in old cases of alcoholism. The arachnoid and pia mater become thickened and adherent to one another and to the surface of the brain. In *alcoholic*

dementia, fatty degeneration and atheroma of the bloodvessels are the most characteristic conditions, but in *general paresis*, the neuroglia is principally involved by the sclerotic process.

The *spinal cord* does not exhibit any conspicuous change, but the tremors that are observed in chronic alcoholism are probably due to molecular changes in its structure.

It is in the *peripheral nerves* that the most characteristic lesions are observed. These will be described in the chapter on peripheral neuritis and paralysis.

Prominent among the disturbances of the brain that are produced by chronic alcoholism are simple *alcoholic delirium*, *delirium tremens*, and *alcoholic dementia*. It is among debilitated subjects with an unstable nervous organization that delirium is most commonly observed. It is characterized by depression and terror. The hallucinations by which it is accompanied are of a frightful and agonizing character. They are usually connected with the sense of sight. The patient sees horrible creatures who surround and attack him, rousing him to a violent activity against imaginary dangers by which he is threatened. These hallucinations are usually colored by the habitual occupation of the patient, and have their origin in his daily associations and pursuits. Twilight deepens the intensity of such visions, but they usually disappear in broad daylight.

Alcoholic delirium is always accompanied by *muscular tremor*, though in mild cases they are only manifested in connection with voluntary movements. In severe cases the tremor becomes excessive, and so incessant that it persists even during sleep. This condition is termed *delirium tremens*. It differs also from simple delirium by the fact that the temperature is elevated beyond the normal degree. The skin is moist with perspiration; the breath is offensive; and intense prostration of the entire nervous system is manifested.

These states of delirium and exhaustion are frequently witnessed after a prolonged debauch. They may occur as complications in the course of acute diseases, or after injuries, surgical operations, etc., especially if the patient be suddenly deprived of his accustomed stimulant.

Alcoholic dementia constitutes the terminal condition of cerebral degeneration in chronic alcoholism. It is the result of extensive and progressive degeneration of the brain. The last developed and most complicated functions of the organ are first abolished. The moral sense becomes obscured; the intellectual faculties fail; imagination disappears; memory weakens; speech becomes hesitating and embarrassed; sensation is blunted; the power of movement is diminished, and the unhappy victim sinks into a condition of vegetative life, interrupted only by occasional brief paroxysms of delirium or of maniacal fury.

The *skin* frequently shares in the ruin that is wrought by chronic alcoholism. The red face, swelled nose, and fiery cheeks adorned with pustules of acne, are familiar sights in every jovial gathering of confirmed drunkards. Eczema is a common form of eruption, and all cutaneous diseases, whether syphilitic or simple in their character, are

atly aggravated and rendered more intractable when complicated
h alcoholism.

The characteristic symptoms upon which the *diagnosis of chronic
oholism* is based are nausea and vomiting on arising in the morning,
irium of a depressing and terrifying character, shooting pain in the
er extremities, a feeling of constriction about the calves of the
, partial anæsthesia in different parts of the body, disturbances of
it and other organs of special sense. Convulsions usually follow
use of absinthe, but they sometimes occur in the later stages of
ere alcoholism.

Alcoholism yields a most unfavorable *prognosis* on account of the
found lesions by which it is accompanied. Its effects upon the
lth, well-being, and usefulness of the individual are beyond all
sibility of estimation. Not only does the victim of intemperance
fer in his own person, but his descendants for several generations
p the fruits of his folly. Drunkenness, hysteria, epilepsy, mental
l moral degradation form the pitiable heritage of these unfortunate
ngs.

Acute alcoholism requires little *treatment* beyond a favorable oppor-
nity for sleeping off the effects of intoxication. In minor forms of the
ease cold effusions upon the head and back of the neck, accompanied
the administration of ten grains of muriate of ammonia, will usually
e speedy relief. Hence the great virtue ascribed to an acquaintance
h the village pump after a night at the ale house.

Chronic alcoholism is seldom curable unless the patient possesses
ficient determination to abandon his potations before the establish-
nt of irremediable disease in the liver and brain. Long seclusion in a
per asylum often affords the only effectual means of recovery. The
t should be invigorating and easily digestible. Gastro-intestinal
arrh requires the ordinary treatment for that disease. Its suppression
uld be the signal for the administration of tonics and restoratives;
ong these iron, quinine, strychnia, arsenic, and the simple bitters
the most effectual. The inordinate craving for stimulants may be
en effectually subdued by the administration of atropine or other
anaceous alkaloids. These should be administered hypodermically
intervals of four hours, until the appetite for alcohol is suppressed.
ocarpine may be used at the same time, to counteract excessive dry-
s of the mouth. A favorite prescription, in certain quarters, consists
he following formula:

℞.—Daturin. sulph. gr. j.
Strych. nitrat. gr. ij.
Acid. boracic. gr. viij.
Aq. destillat. ℥ij.—M.

S.—Five to ten minims, hypodermically, every four hours.

At the same time the patient is instructed to take, every two hours,
aspoonful of the following mixture:

℞.—Tr. cinchon. co. ℥iv.
Aur. et sod. chlorid. gr. ss.
Ammon. chlorid. gr. ij.
Aloin. gr. j.
Syr. simpl. ℥iv.—M.

Delirium tremens requires careful nursing and constant watching of the patient. Milk, broth, and eggs should be abundantly furnished, and capsicum may be given as a cardiac tonic. For the relief of exhaustion and danger of cardiac failure the following pill will be found serviceable:

℞.—Pul. capsici.
Pulv. gum. camphor.
Quin. sulph. } āā gr. j.

S.—One such pill every three or four hours.

Sulphonal is the safest hypnotic. Opiates should be avoided. Cold baths are useful when the temperature is considerably elevated.

CHAPTER X.

MORPHINISM.

Morphinism is that morbid condition which follows the abuse of opiates, usually morphine taken hypodermically. The fully developed habit constitutes what is termed *morphiomania*, a state of mind and body characterized by an irresistible appetite for opiates. The victims of this disease are frequently sufferers from painful disorders for which opium or morphine have been employed in order to deaden pain and to render life tolerable. The appetite thus formed continues after the cure of the original disease. In other cases, however, the habit is acquired simply for the purpose of awakening pleasurable sensations. In many instances the victims of morphiomania are neurotic subjects who belong to a degenerated and degraded stock. They exhibit an uncontrollable appetite for other narcotics, such as alcohol, chloral, cocaïne, etc.

So great is the rapidity with which the opium habit may be established that the greatest caution should be exercised in the prescription of anodynes for patients whose intelligence may lead them to supply themselves after the attendance of the physician has ceased. Not more than six or eight months are necessary for the complete establishment of the habit.

The *subjects of confirmed morphiomania* present a prematurely aged appearance. The face is wrinkled, pale, and of a dirty-yellow color. The pupils are contracted. The power of volition is greatly enfeebled, though the other intellectual faculties suffer comparatively little. If deprived of the customary dose, exhaustion, trembling of the limbs, depression of spirits, and nervous prostration are apparent; but a renewal of the accustomed stimulant relieves all these symptoms, and the patient revives once more under the influence of the drug.

The habitual use of opiates is followed by a dryness of the *mouth* and rapid decay of the teeth. The *appetite* is diminished, though in the later stages of the disease there may be intense craving for all kinds of food. *Digestion* is hindered, and the stomach is embarrassed by

rmentation, causing numerous painful sensations in the epigastric gion. *Constipation* is the rule, though sometimes there is diarrhœa d distention of the bowels with gas.

The *pulse* is often weak and intermittent; palpitation of the heart is equent. *Respiration* is sometimes weak and impeded, especially hen the drug has been withdrawn for a period longer than usual.

The *urine* sometimes contains sugar or albumin. The *generative culties* are diminished and frequently disappear altogether. *Menruation* is often greatly disordered.

When *morphine is used hypodermically*, the *skin* exhibits innumera- e marks produced by the puncture of the needle. These sometimes ver the entire anterior portion of the body and extremities. Slow d painful suppuration often follows the use of needles that have not een carefully cleansed.

The effects of injuries are aggravated, and their cure is retarded, by e habitual use of opiates. When attacked by an acute disease the orphiomaniac sometimes experiences a form of delirium identical with elirium tremens and alcoholism.

The *duration* of the morphine habit is usually conterminous with fe. Chronic opium-eaters finally become profoundly cachectic; some f them die of tuberculosis, others yield to chronic inflammation of the idneys, and death sometimes results from erysipelas or pyæmia, aused by infection at the point of puncture.

There are many points of resemblance between alcoholism and morhinism. Their development is, however, different. Alcohol first inades the digestive organs and then destroys the nervous system, while he opposite course characterizes the effects of opium.

TREATMENT. It is impossible to conduct the treatment of the morhine habit with any degree of success unless the patient be placed in hospital under strict medical supervision for at least four or six eeks. The drug should be reduced gradually at the rate of one-quarer or one-half of a grain of morphine every other day, and tonics in ie form of the elixir of iron, quinine, strychnine, and arsenic should e administered. Sleep should be procured by the use of sulphonal. f the symptoms of acute neurasthenia appear, alcoholic stimulants in ie form of champagne may become necessary, and sometimes it is necssary to increase a little the amount of the opiate. Warm baths should e given every morning and evening, and they may be followed by a old shower-bath along the spine. Massage is also very useful. After ie conclusion of the treatment the patient should be sent to a saniarium or water-cure establishment until his physical vigor is fully estored.

The opium habit is sometimes treated by immediate suppression of the rug. This course is speedily followed by great prostration and misry, which continue from three to five days. The patient is restless nd full of pain. Respiration is hurried and the pulse beats very rapdly. The throat burns, and the stomach feels as if wounded or corched. Nausea, vomiting, and diarrhœa follow with all the symptoms of complete prostration. At the end of four or five days the apetite for food begins to return. Insomnia and depression still exist,

and suicidal tendencies are sometimes manifested. There is persistent diarrhœa, which, however, should not be treated with opiates or astringents. Food should be given frequently in small quantities. It should consist of eggnog, chicken broth, milk, and beef-tea. The elixir of iron, quinine, and strychnine may be given every four hours, with bismuth for nausea and diarrhœa. At the end of the tenth day the desire for opiates is abolished, but careful nursing and tonic treatment should be continued for weeks or months until vigorous health is restored, otherwise relapses will occur.

CHAPTER XI.

COCAÏNISM.

Cocaïnism produces an exhausted condition of the heart, that is marked by an irregular and rapid pulse. Respiration is accelerated; there is profuse perspiration and diarrhœa. Syncope is not uncommon, and the sexual power is often destroyed. The patient loses flesh notwithstanding the preservation of the appetite and the power of digestion. The mental faculties are seriously disordered. Hallucinations and illusions are commonly experienced, and involve all the organs of special sense. Cutaneous sensibility becomes perverted, so that the patient complains of insects creeping upon the skin. Delirium and delusions of persecution are frequently experienced. Memory fails; the power of volition is enfeebled, and all the intellectual faculties are rapidly degraded.

The abuse of cocaïne is followed by results that are more serious and irremediable than the effects of either alcohol or opium. The drug should never be employed as a substitute for opiates or other narcotics in the treatment of the opium habit.

The treatment of cocaïnism must be conducted upon the same plan as that which has been already described in the case of morphinism.

CHAPTER XII.

CHRONIC NICOTINISM.

THE principal poisonous constituent of tobacco is the alkaloid nicotine, which is one of the most potent poisons. Besides nicotine, a number of poisonous substances are formed during the combustion of tobacco. Among these are hydrocyanic acid, collidine, which gives the characteristic odor to the smoke of Havana cigars, and other deleterious substances.

ronic nicotinism is usually experienced by those who smoke
, and by cigarmakers who are continually handling tobacco. The
pal symptoms consist in an impairment of memory, vertigo, mus-
tremor, and neuralgia. *Tremor* is usually observed in the act of
ıg or in connection with other voluntary movements. *Vertigo*
ɔe occasioned either by disordered digestion or by the direct in-
ɛe of tobacco upon the nervous system. *Neuralgia* is usually
ienced in the branches of the brachial and cervical plexuses.
times the pain of angina pectoris is closely counterfeited by
ılgia having its origin in the tobacco habit.

e *mouth, fauces*, and *pharynx* are usually in a condition of sub-
inflammation when subjected to the repeated influence of tobacco
ɛ. The teeth decay rapidly. When the mucous membrane of
ırynx is invaded by inflammation, hoarseness and a spasmodic
: are frequently experienced. *Loss of appetite, acidity of the*
:ch, and *difficult digestion* are frequent incidents.

ganic diseases of the heart are not produced by tobacco, but the
s of the organ suffer severely under its influence. The rhythm of
ılsations is disturbed, and palpitation, or irregular and inter-
ıt pulsation, are frequently observed.

e *functions of smell and of taste* are considerably impaired by
ɔntinued use of tobacco. *Amblyopia* is sometimes experienced.
ɟenerative functions are greatly depressed, and sometimes result
nplete impotence. *Abortion* frequently occurs, and the offspring
: victims of the tobacco habit are often debilitated and degraded.

EATMENT. The treatment of chronic nicotinism requires absti-
from tobacco, regulation of the digestive functions, the adminis-
n of tonics, iodide of potassium, and alcoholic stimulants in
:ation. Tannic acid is said to be an antidote to nicotine, hence
:putation of coffee, tea, and red wine, as remedies in the treatment
otinism.



PART IX.

DISEASES OF THE KIDNEYS AND GENITO-URINARY ORGANS.

CHAPTER I.

GENERAL RENAL DISEASES.

Albuminuria.

Albuminuria consists in the presence of albumin dissolved in the ne. *True albuminuria* signifies the union of albumin with the ine as it is secreted by the kidneys. *False albuminuria* signifies a xture of albumin with the urine during its transit through the inary passages, where it may be derived from blood, pus, or special ɔretions that contain albumin. Mixed forms of albuminuria may also ist in which genuine albuminous urine is still further reinforced in e urinary passages by substances that yield albumin.

True albuminuria exists under two forms: one in which the pres-ce of albumin is caused by anatomical changes in the kidneys them-ves (renal albuminuria); the other is dependent upon special nditions of the blood without change in the condition of the kidneys ematogenic albuminuria).

True renal albuminuria is indicated by the presence of renal casts l tubular epithelium. *False albuminuria* is characterized by the sence of albumin in quantity proportioned to the blood, pus, or er albuminous constituents which are also present in the urine.

Varieties of albuminuria. The most common form of albumin is *um-albumin*, such as exists in the serum of the blood; but, besides s variety, *serum-globulin*, *peptone*, *propeptone*, *paralbumin*, and *albumin* may also be found in certain morbid specimens of urine. e following tests for these principal forms will be found useful:

Tests for Serum-albumin.

Nitric acid test. If the specimen to be examined be turbid, it should filtered; or, if that be insufficient, it should be shaken with magnesia ore it is filtered. If it contain oil, after the addition of a small antity of caustic potash or soda, it may be shaken with ether, which ll remove the oil.

Having thus prepared a clear and limpid urine, a test-tube may be filled to about one-fifth of its depth with urine, which must then be heated to the boiling-point and treated with about one-fifth of its volume of nitric acid, by which the albumin will be precipitated in a flaky mass; or, if present in small quantity, will appear as a faint, white cloud. If the urine be neutral, or only slightly acid, it will be clouded by heat, in consequence of the expulsion of the carbonic acid gas by which earthy phosphates were held in solution; but upon the addition of nitric acid, the phosphates are again dissolved and disappear, while the albumin becomes even more apparent. When alkaline urine that contains albumin is heated, albumin is not necessarily precipitated, since it forms a soluble alkali-albuminate which, however, will be precipitated by the addition of nitric acid.

After swallowing balsamic preparations, such as oil of turpentine, balsam copaiva, etc., a precipitate of resinous matters will be produced by the addition of nitric acid, even though albumin be wanting. The addition of alcohol promptly clears up such a precipitate.

Another method of employing the nitric acid test consists in the gradual addition of filtered urine to nitric acid in a test-tube, down one side of which the urine is made to trickle, drop by drop, until it forms a layer above the acid. At the point of contact between the two liquids will appear a white ring of albumin. A layer of urinary pigment is sometimes developed immediately above and below the layer of albumin.

Acetic acid test. To urine that has been boiled in a test-tube, acetic acid may be cautiously added, when, if albumin be present, it will be precipitated, as in the previous test with nitric acid. If an excess of acetic acid be employed, a soluble acid-albumin is formed which remains invisible in the urine.

Picric acid test. The addition of concentrated picric acid to filtered urine causes a precipitate of albumin. A somewhat similar precipitate also appears if quinine or potassic salts are present in the urine. Peptone is also precipitated by picric acid, but is again dissolved if the mixture be subjected to a boiling temperature.

Metaphosphoric acid test. A small quantity of glacial metaphosphoric acid should be dissolved in distilled water and added to filtered urine in a test-tube, when albumin, if present, will appear as a white cloud. This test has the advantage of producing the precipitation of peptone as well as albumin.

Ferro-cyanide of potassium and acetic acid test. Having mixed equal parts of filtered urine and a saturated solution of ferro-cyanide of potassium in a test-tube, acetic acid may be added, drop by drop, when the presence of albumin will be indicated by the appearance of a white cloud.

Sulphate of sodium and acetic acid test. To equal parts of filtered urine and a saturated solution of the sulphate of sodium, add acetic acid, drop by drop, until the mixture gives a decidedly acid reaction; then, on the application of heat, albumin, if present, will be precipitated.

Trichloracetic acid test. A crystal of trichloracetic acid may be shaken with filtered urine in a test-tube; as soon as the crystal begins

re, albumin will be precipitated around it in the form of a
ud.
rous other tests may be found described in various works on
gical Chemistry.
for paraglobulin. If urine be saturated with sulphate of
m, paraglobulin, if present, will be precipitated and can be
by filtration, after which process the filtrate may be tested by
ary methods for serum-albumin.
or propeptone. To urine that has been boiled and cooled, on
ion of acetic acid or nitric acid, if propeptone be present, a
recipitate will appear, which will again disappear if the urine
l.
or peptone. Peptone is not precipitated from warm urine by
ion either of nitric acid, acetic acid, or ferro-cyanide of potas-
acetic acid. But, if the urine be treated with alcohol, or
aphosphoric acid, or with picric acid, peptone, if present, will
itated, and will impart a violet color to an alkaline solution of
of copper.
uantity of albumin which may be discharged each day, through
, presents great variations. In certain cases only a trace can
ered, while in others a full ounce may thus be lost. The most
nt method of ascertaining the percentage of albumin in a
antity of urine, is afforded by the use of Essbach's albu-
er. This little instrument consists of a test-tube which is
with a rubber cork, and is graduated in such a way that equal
s of urine and the reagent may be readily measured. The
ld be filled with filtered urine to the letter U. It is then
to the letter R with a solution which consists of 10 parts of
d, 20 parts of citric acid, and 1000 parts of water. The tube
e tightly corked and thoroughly shaken, when albumin, if
appears in the form of a more or less dense cloud, that is
precipitated to the bottom of the tube. The lower portion of
is graduated in divisions which are numbered from $\frac{1}{2}$ to 7.
ivisions correspond to the number of grammes of albumin
e contained in a thousand cubic centimetres of the urine that
ted to examination. If, after standing for twenty-four hours,
nn of albumin reaches figure 3, it indicates three grammes of
in a thousand cubic centimetres of the urine, or 0.3 per cent.
ine contains more than 0.7 per cent., it must be diluted with
quantity of water, and the percentage of albumin may then
ned by doubling the product that is indicated upon the gradu-
sure.

S OF ALBUMINURIA. In many instances a small quantity of
can be found in the urine of healthy individuals, constituting
termed *physiological albuminuria.* This sometimes appears
ng eggs, or other articles of food that are rich in albumin. It
mes present as a consequence of mental depression, or after
s, or considerable sexual excitement. It is not uncommon for
ime at the commencement of puberty. It may follow copious
ion, and it is sometimes observed as a periodical event, occur-

ring in successive cycles for a long period of time. The cause of such physiological albuminuria is not clearly understood.

Albuminuria is frequently observed during the course of infective fevers and other febrile conditions, when the temperature is for a considerable time greatly elevated. It is not improbable that in such cases the direct action of infective microörganisms, or their products, upon the kidneys, determines the appearance of albumin.

Nervous albuminuria is sometimes observed in association with severe diseases of the nervous system, especially those which are attended by delirium and convulsions.

Albuminuria is a not uncommon incident in the course of cutaneous diseases, maladies that are attended by great loss of blood, anæmia, and cachexia. It is also observed as a consequence of poisoning with lead, or the mineral acids, alkalies, phosphorus, cantharides, chromic acid, morphine, chloroform, carbolic acid, etc. It follows the development of obstructions in the course of the circulation; it also results from diseases of the kidneys, or obstruction in the urinary passages.

The *principal source of urinary albumin* is located in the glomeruli and in the epithelium of the convoluted tubules of the kidneys, since one of the functions of the epithelial cells in the glomeruli, and to a certain extent in the convoluted tubules, consists in the prevention of the passage of albumin from the blood into the urine. Every cause, therefore, that impairs the structure and functional efficiency of those epithelial cells favors the discharge of albumin. Changes in the blood pressure and alterations in the quality of the blood itself, favor the occurrence of albuminuria.

TREATMENT. In all forms of albuminuria, dietetic and hygienic measures are of the greatest importance. The patient must be warmly clothed, and must avoid chilling the surface of the body. Cold baths are injurious, but warm baths may be frequently enjoyed with great advantage. All excessive exertion and copious perspiration should be avoided; and, during cold weather, a warm climate may be recommended for those who can change their residence. The diet should consist chiefly of milk, fatty substances, and eggs. Strong tea, coffee, spices, and alcoholic beverages must be forbidden; red wine may be permitted in moderation on account of the tonic properties which are conferred upon it by the presence of tannin. Of internal remedies, tannic acid and aloes are among the most valuable.

℞.—Acid. tannic. ℈ijss.
Aloin. gr. iij.—M.

Ft. pil. no. c.
S.—Four pills after each meal.

Hæmaturia.

Hæmaturia is indicated by the presence of red blood-corpuscles in the urine. This differs from hæmoglobinuria, in which only the hæmoglobin of the blood is present.

Hæmaturia is a symptom which may follow wounds or injuries of the kidneys, or may accompany the intoxication that is produced by certain drugs, *e. g.*, cantharides, oil of turpentine, and, occasionally, by

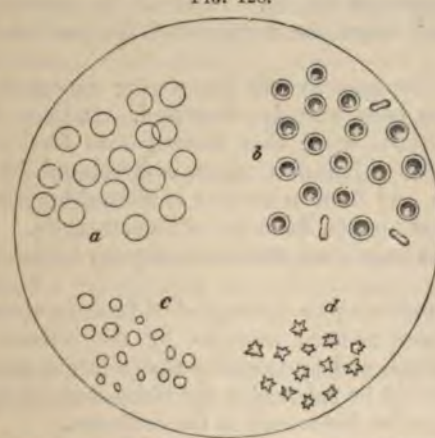
stion of other remedies. It also appears in the course of many diseases, notably in the course of severe forms of malarial It is observed in blood diseases like scurvy, purpura, and ilia. It often results from embolisms, or thrombi, or aneurisms, l stasis, affecting the renal vessels. It accompanies inflamma- d neoplasms in the renal tissues. Parasitic invaders, such as ccus, distomum hæmatobium, and filaria sanguinis, frequently hæmaturia. It also accompanies tuberculosis and calculi in l pelves.

aturia is frequently observed in association with diseases or ithin the bladder. Inflammation and ulceration of the mucous ne of the bladder, and varicosity of the veins of the bladder, are e cause of a bloody discharge with the urine.

n blood escapes from the urethra, it is, usually, in consequence of or injuries which have been inflicted upon its mucous membrane. ithstanding these numerous causes, many cases of hæmaturia thout any apparent cause that admits of discovery.

TOMS. *Hæmaturia* is indicated by a change in the color of the nd by the discovery of red blood-corpuscles in that liquid. uantities of blood cause the urine to appear like water in which it has been washed, while a large quantity changes the color to y or coffee-black color. When the blood proceeds from the passages, the color of the urine may remain unchanged, be- e blood is then deposited in the form of a clot. The reaction of ne is generally acid, unless a large quantity of blood from the be mixed with it. If the alkaline reaction be due to a vola- ali, red litmus paper which has been turned blue by the urine ume its red color on drying; otherwise the alkaline reaction is he presence of fixed alkalies.

FIG. 128.



scles. *a*. Without reagents. *b*. After the addition of acetic acids. (ROBERTS.)

n the *urinary sediment* contains blood clots, they generally pro- m the pelves of the kidneys, or from the ureters, and may exhibit

When hæmaturia originates in the kidneys the blood
usually associated with casts upon which the corpuscles a
crystals are frequently deposited.

For accurate details with regard to spectroscopic inve
urine, the student is referred to the larger manuals and
iological chemistry.

A very convenient *test for the presence of blood i*
furnished by the following method: To a small quantit
test-tube may be added one-third of its volume of a solu
potash (1:3). On heating the mixture, earthy phosph
gray color will be precipitated. If blood be present, the
the blood corpuscles will be liberated and will be carried
phosphates, which will then present a reddish-brown or
The precipitate is, moreover, dichroic, appearing red by
and greenish by transmitted rays. If the urine be alka
application of the test, it should be mixed with an e
healthy acid urine, after which the reaction will prove s

Another test for the presence of blood consists in the
drops of tincture of guaiac to a small quantity of urine
To the mixture should be added a few drops of turpentin
ozonized by exposure to the air. If blood be present,
color is developed when the contents of the test-tube
gether.

DIAGNOSIS. *Hæmaturia* will be readily recognized
toms which have been already described. It must be
from the concentrated urine that accompanies fever an
also from the urine of jaundice, which is discolored by
biliary pigment; and from urine that is altered by carbo
the use of rhubarb, senna, fuchsine, or hæmatoxylin. M
hysterical persons sometimes attempt deception by the ad

n, and by the presence of large clots or the detritus of broken-down ors when neoplasms or calculi have invaded the bladder.

Iemorrhage from the urethra may be readily discovered by pressure a the walls of the canal and by the appearance of small quantities lood at the commencement of the act of micturition.

REATMENT. The treatment of hæmaturia must be guided princi- y by the consideration of its causes. The patient should remain tly in bed, and may receive a hypodermic injection of the fluid ex- t of ergot three times a day. Styptics may be administered inter- y, as in other cases of hemorrhage.

Hæmoglobinuria.

TIOLOGY. *Hæmoglobinuria* is characterized by the presence of ioglobin in the urine. Its source is within the bloodvessels, where blood corpuscles have undergone *dissolution*, and the resulting pig- t is left for excretion by the kidneys. This may occur as a conse- ice of *poisoning* with sulphuric acid, or hydrochloric acid, or sul- retted hydrogen, or chlorate of potassium, or pyrogallic acid, or olic acid, or various other substances. It sometimes occurs in iection with severe jaundice, and it may be produced by extensive is, or by the transfusion of blood from the lower animals. It fre- itly occurs in connection with *infective diseases*, and with *hemor- ic diseases* of the blood, such as scurvy, purpura, etc. It has been essed as a consequence of *fatty embolism* after fractures of the bones. a many instances, however, no apparent cause can be discovered. ietimes it occurs paroxysmally (paroxysmal hæmoglobinuria).

YMPTOMS AND DIAGNOSIS. *Hæmoglobinuria* may be recognized by color of the urine, and by its coagulation, when heated, with the iation of large albuminous clots that float upon the surface and are ied with blood pigment. Microscopical investigation of the uri- sediment, in hæmoglobinuria, indicates the presence of minute iules of precipitated hæmoglobin, together with hyaline and fatty l casts and epithelial cells which are stained with blood pigment. stals of hæmatoidin and uric acid are frequently present.

elanuria. *Melanuria* is observed in cases where melanotic tumors t in some portion of the body.

laucosuria signifies the presence of *indican* in the urine, by which liquid is colored a dark purple hue, and deposits a sediment of in- blue.

hyluria has already been described in connection with its parasitic e—filaria sanguinis hominis (p. 80).

ipuria is indicated by the presence of oil which appears in circular upon the surface of the urine. This occurs, sometimes, after ex- ve use of fats and oils, or in the course of diabetes mellitus, or ises of the pancreas, or of the heart, or chronic diseases that favor

amyloid degeneration. It also occurs during pregnancy, or as a consequence of poisoning with phosphorus or coal gas, and after fracture which occasion the formation of fatty emboli. It may also occur in the course of acute fatty degeneration of the liver and kidneys.

Fibrinuria signifies the presence of fibrin in the urine to an extent that produces its coagulation after the liquid has been voided. It usually occurs in the course of villous cancers of the bladder, or after the use of cantharides. It is said to be endemic in Madagascar and in Brazil.

Hydrothionuria consists in the presence of sulphuretted hydrogen in the urine. The source of the gas may be sometimes referred to the alimentary canal, or to peritoneal abscesses in which decomposition has taken place.

CHAPTER II.

DISEASES OF THE RENAL PARENCHYMA.

Ischæmia of the Kidneys—Ischæmia Renalis.

ETIOLOGY. The structure and function of the kidney are dependent upon the integrity of its arterial supply. Any deficiency in this respect occasions alteration in the nutrition of the epithelial cells in the convoluted tubules and glomeruli. Cloudy swelling and fatty degeneration follow, by reason of the deficient supply of oxygen to which they are subjected. The escape of albumin from the blood follows as an immediate consequence of this structural deterioration. The most perfect examples of *renal ischæmia* are witnessed in the course of cholera and of pregnancy, though minor forms of the same disorder exist in connection with exhausting diarrhœa, or sudden hemorrhages, and in diseases which occasion great reduction in the number of red blood-corpuscles, or of their hæmoglobin, *e. g.*, chlorosis, leukæmia, progressive pernicious anæmia, cancer, syphilis, malaria, tuberculosis, etc.

Every condition that favors the development of arterial spasm, *e. g.*, lead colic, epilepsy, tetanus, colic, and eclampsia, may cause the renal structure to suffer from an insufficient supply of blood, through the occurrence of arterial spasm.

PATHOLOGICAL ANATOMY. In typical cases the kidney often appears enlarged; its surface is smooth, and it is softened. The cortical portion is increased, and is of a pale yellow color, while the medullary portion exhibits a state of hyperæmia. The epithelial cells of the tubules show the signs of fatty degeneration.

SYMPTOMS. The symptoms depend upon the degree and duration of ischæmia. The urine is *deficient in quantity*, and exhibits the presence of albumin and casts. The subcutaneous tissues are *œdematous*, some-

es even before the appearance of albuminuria; in other cases œdema ntirely absent. The urine is diminished in quantity, and its specific vity is increased, but the amount of albumin rarely exceeds two ts in the thousand. In cases of pregnancy its quantity is usually atest at the time of parturition. Hyaline casts, often covered with ute oil globules, and tubular epithelium may be found in the iment.

The *duration* of the disease is variable, and when associated with gnancy, may soon disappear after parturition, rarely resulting in ght's disease.

Among the most serious complications must be reckoned *eclampsia*. nvulsions are sometimes preceded by vomiting, diarrhœa, headache, ; but, sometimes, they occur without warning, during a condition of na. It should not be forgotten, however, that convulsions during gnancy are not always dependent upon renal disease. Opinions are divided with regard to the cause of convulsions, whether it consists the retention of urinary constituents, or in an anæmic and œdema- s condition of the brain.

DIAGNOSIS. In cases of pregnancy it must be carefully considered ether the disorder is dependent upon simple renal ischæmia, or ether the pregnant condition was not preceded by a diffuse nephritis t may terminate in Bright's disease.

PROGNOSIS. The prognosis is favorable in cases of simple ischæmia.

TREATMENT. The treatment depends upon the cause of ischæmia. n and quinine should be administered in cases of anæmia during gnancy. Eclampsia requires the hypodermic administration of rphine, and the inhalation of chloroform, or the use of clysters con- ning chloral. Parturition should be terminated as quickly as possi- . Whether premature delivery should be effected, is still an open estion.

Venous Hyperæmia of the Kidneys.

ETIOLOGY. *Renal stasis* occurs whenever the renal veins are in any y obstructed. This usually follows diseases of the organs of circu- on and respiration; in other words, whenever the exit of blood m the right side of the heart is impeded.

In certain cases the impediment may be caused as a local obstruction thrombosis in the renal veins, or in the course of the inferior vena a.

As a consequence of blood stasis, the arterial supply of the kidneys st necessarily be reduced; consequently the amount of urine that is reted is also diminished.

PATHOLOGICAL ANATOMY. The kidney is unusually large, and sents a purple color. The *capsule* is tense, transparent, smooth, l can be easily stripped from the organ. The *stellate veins* upon surface appear distended, and minute extravasations of blood are metimes visible. The *parenchyma* is firm and resistant, and of an usually dark color. The *glomeruli* are frequently visible in the form dark-red points. The total condition is often indicated by the term *notic induration of the kidneys*.

epithelium, which produces atrophy and contraction of th
tion of the organ.

SYMPTOMS. The urine is diminished in quantity, a
gravity is increased to 1030 and upward. On cooling,
urates is deposited which contains round cells, occasion
puscles, and epithelium from the bladder and urinary pas
casts, with adherent oil globules and tubular epithelium,
present. Albuminuria is often absent; when present, i
small.

Since the renal disease is dependent upon blood stasis
origin elsewhere, the symptoms of obstructed circula
organs will be observed. Dyspnœa, cyanosis, palpitatio
are frequently developed.

DIAGNOSIS. From *actual nephritis* renal hyperæmia i
by the frequent absence of albumin from the urine, o
quantity when present. Casts are less numerous than i
phritis. If any considerable quantity of blood be appare
in connection with cardiac diseases, the possibility of r
should not be neglected; the embolic process is indica
pain in the kidneys, chills, fever, and vomiting.

PROGNOSIS. The prognosis is not unfavorable so far
are concerned, though the underlying causes are often
great danger.

TREATMENT. The dependence of the disease upon c
is so common that treatment must be principally addre
vigoration of that organ. For this purpose nutritious
digitalis or its substitutes, may be recommended (p. 54
must be administered when the quantity of urine is consi
ished; for this purpose may be recommended the aë

ease. Debilitated patients require stimulants and tonics, such as lerian, camphor, and the compound tincture of cinchona.

Diffuse Inflammation of the Kidneys—Morbus Brightii.

Bright's disease is a term that is applied to inflammations of the dneys which involve their entire structure. The disease may be either ute or chronic; acute inflammation may pass gradually into the ronic form, but chronic inflammation often begins independently as ch.

Renal inflammation is by no means limited to any special tissue of the gan, but it may manifest itself more conspicuously in one tissue than another, according to the circumstances of the case. The terms *renchymatous inflammation* and *interstitial inflammation* merely dicate the predominance, in the one case, of inflammation in the paren-yma, while, in the other, it is the connective tissue that principally fers inflammatory change. In a third class of cases, both tissues may equally involved.

Under the general term, Bright's disease, are therefore included ute and chronic inflammations of the renal parenchyma, and chronic erstitial inflammation of the renal connective tissue.

Acute Parenchymatous Inflammation of the Kidney—Nephritis Acuta Diffusa.

Etiology. *Acute nephritis* frequently occurs in association with epi-mic *infective diseases*, especially after scarlet fever and diphtheria. It more common in cold and damp climates than in mild and equable regions, d is often observed after exposure to sudden chills. It sometimes lows *injuries* and *excessive exertion*. It may be produced by exces-e use of *alcohol*, or by *acrid diuretics* like squills, oil of turpentine, d resinous preparations. Nitrate and chlorate of potassium, salicylic d, the mineral acids, phosphorus, arsenic, and lead, have been known excite renal inflammation. Excessive *cutaneous irritation*, such as y be produced by blisters or irritating inunctions, sometimes pro-ces inflammation of the kidneys. Its connection with infective dis-es, syphilis, consumption, and malarial poisoning are well known. certain cases, the capillary loops within the glomeruli have been nd occluded by *emboli that were composed of micrococci*. It is bable that if the microörganisms themselves do not excite inflamma-n, their products and excretions which enter the kidneys are suffi-nt to produce the disease. Acute nephritis is also associated with cer-n cases of *dyscrasia*, *e. g.*, scurvy, purpura, etc. It may also occur a *secondary consequence of inflammation* involving the urinary sages. The existence of *cardiac disease* exercises a favoring effect n its development.

Pathological Anatomy. The changes that are produced in the ucture of the kidney sometimes require the aid of the microscope their demonstration. When visible to the naked eye they produce unusual enlargement of the organ. Its *capsule* appears smooth and

Its substance is traversed by yellow streaks which in
degeneration. Hemorrhagic points are in certain ca
the surface of the organ and within its substance. I
this variety of inflammation exists independently, an
resent the later stage of the previous variety, though
this may sometimes occur.

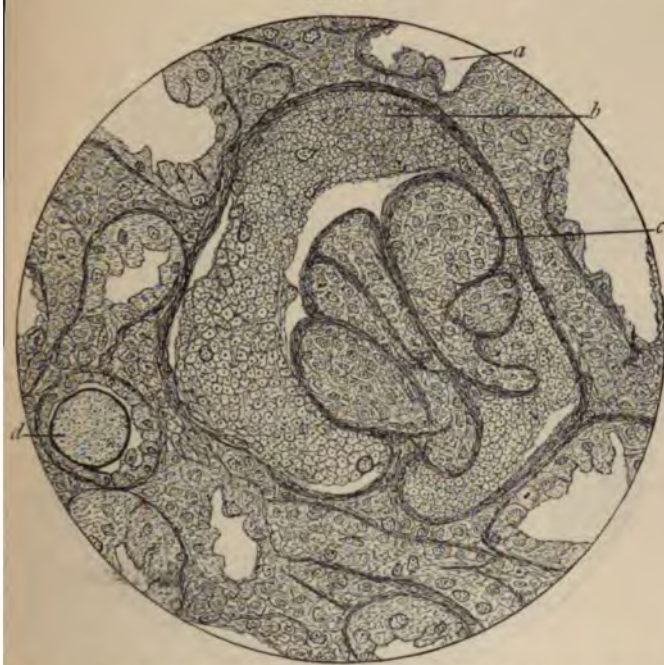
In certain cases microscopical examination reveals
flammation is restricted almost exclusively to the glom

Fig. 129.



es, inflammatory œdema of the connective tissue, and its infiltra-
n with round cells are common incidents. Hemorrhagic effusions
ually observed in the glomeruli or in the tubuli uriniferi, rarely
connective tissue. Sometimes the pigmentary débris of previous
rhages can be observed in the tubules, or in the connective tissue.
pithelium of the convoluted tubules soon loses its ciliæ, becomes
lar and swollen, and finally undergoes fatty degeneration. (Fig.
The tubules are thus considerably obstructed, and much more

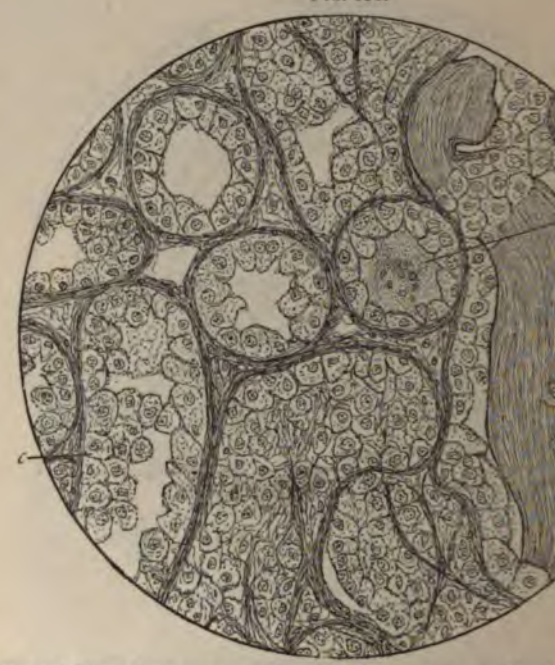
FIG. 130.



atinal nephritis, third week. *a*. Tubule from which epithelium has been ex-
. *b*. Desquamated epithelium of Bowman's capsule. *c*. Compressed tuft. *d*.
tube seen in cross-section. (PURDY.)

en the softened epithelial cells are exfoliated into the passages
ıamative nephritis). Sometimes the epithelium is pushed off
the basement membrane of the tubules by a granular exudation
umin. (Fig. 131.) The cells are deformed and heaped together
ound cells and free nuclei in the tubules (catarrhal nephritis).
e *urinary passages* frequently share in the inflammatory process.
al *dropsy* is also a very common event, and the *heart* becomes
l and hypertrophied.
MPTOMS. *Acute nephritis* frequently commences in a very insid-
nanner. In many instances it has been preceded by a trifling
of scarlet fever or diphtheria; in other cases it begins suddenly
chills and fever, vomiting, loss of appetite, constipation, and

FIG. 131.



Acute nephritis. Transverse section through cortex. *a*. Hyalin
voluted tube. *b*. Cross-section of tubule containing granular cyst.
exfoliated epithelium seen in longitudinal section of tubule. (PURD

tion is sometimes entirely suppressed. The commence

cells, renal epithelium, and casts which are present, together ithelial cells from the urinary passages. In certain cases blood epithelium casts, and fat granules are visible. (Figs. 132, 4).

FIG. 132.



epithelium. *a*. Natural appearance. *b*. Atrophied and disintegrated renal cells. *c*. Renal cells in a state of fatty degeneration. (ROBERTS.)

FIG. 133.



Fatty casts. *b*. and *c*. Blood casts. *d*. Free fatty molecules. (ROBERTS.)

consequence of the affection of the epithelial cells in the con- tubules, the solid constituents of the urine are proportionately hed in quantity, and they increase with the progress of y.

n inflammation has been excited by violent irritants like ides or turpentine, the act of micturition may be attended with



a. Epithelial casts. *b*. Opaque granular casts. From a ca
Bright's disease. (ROBERTS.)

the urine, and the daily quantity of liquid that is
increased; this is always accompanied by an increase
chloride of sodium which, during the inflammatory
retained in the tissues. *Recovery* is not unfreque
subject to frequent relapses. Casts usually remain
time in the urine. In certain cases the disease passes
form of Bright's disease.

Besides dropsy, one of the most dangerous complica
is *uræmia*, which is liable to result from deficient re
the accumulation of urinary constituents in the blood.
ized by severe headache and determination of blo

l maniacal symptoms, associated with the urinary changes that are
aracteristic of nephritis.

DIAGNOSIS. *Acute nephritis* may be differentiated from *venous
yeræmia of the kidneys* by the absence of cardiac or respiratory
eases, and by the more conspicuous presence of morbid constituents
the urine. *Renal embolism* may be distinguished from acute nephri-
by the abrupt development of pain, chills, fever, and vomiting in a
ient who is suffering with previous valvular disease of the heart.
It must always be difficult to differentiate acute nephritis from an
ute exacerbation of *chronic renal inflammation*; in such cases the
tory of the patient will often afford much information.

PROGNOSIS. *Acute nephritis* is frequently followed by complete re-
ery, but the disease is attended with so many dangers that the
gnosis should be expressed with great caution.

TREATMENT. The diet must consist chiefly of milk, broth, and tender
at; tea and coffee must be forbidden, since they are irritating to the
neys. The patient should remain warm in bed, and should have a
rm bath every morning and evening. The bowels must be moved
ry day, for which purpose may be prescribed the compound infusion
senna, or the compound licorice powder. If malaria or syphilis have
asioned the inflammation, quinine, or mercurial preparations and
ine, should be prescribed. For the relief of hæmaturia and albumin-
ria, styptics are of very little value; leeches and cups have been fre-
ently employed, but they are generally unnecessary. Diuretics
uld be administered whenever the urine is greatly reduced in amount,
all irritating and acrid remedies should be avoided. Mild saline
uretics, like aërated waters, citrate and bitartrate of potassium, are the
st useful remedies. Dropsy may be combated by the administration
diaphoretic remedies and hot-air baths. Pilocarpine and morphine
y be administered hypodermically for the purpose of promoting
spiration.

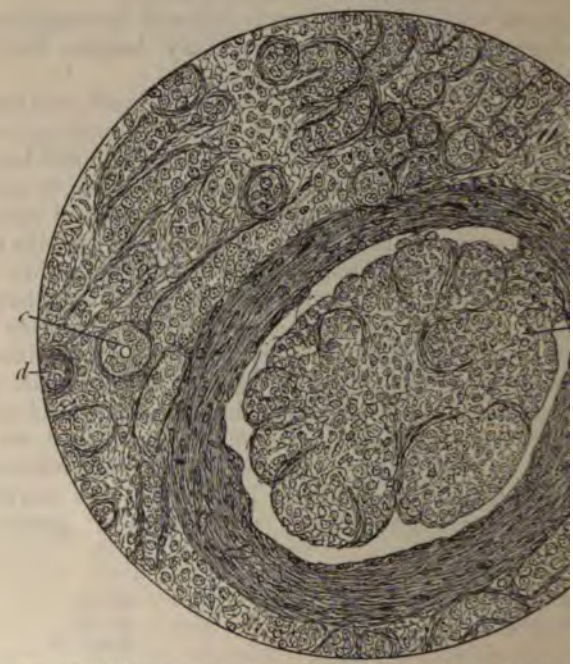
℞.—Pilocarpin. hydrochl. gr. $\frac{1}{20}$.
Morph. sulph. gr. $\frac{1}{10}$.
Aquæ ℥ss.—M.

ronic Parenchymatous Inflammation of the Kidneys—Nephritis Chronica Parenchymatosa Diffusa.

ETIOLOGY. *Chronic parenchymatous nephritis* is usually developed
a primary disease. It most frequently occurs between the twentieth
fiftieth years of life, and is more common among men than among
nen, in cold and damp climates. In many cases it originates with-
any apparent cause, but in other instances it can be directly traced
xposure to cold, or to the influence of malaria, or syphilis, or chronic
ting discharges.

PATHOLOGICAL ANATOMY. The *kidneys* are greatly enlarged in size
weight. The *capsule* is dense and easily stripped from the organ,
ch presents a yellowish-gray color. The *stellate veins* upon the
face are locally dilated. The *cortical portion* is greatly reduced and
trasts strongly with the reddened and highly injected medullary

FIG. 135.



Chronic nephritis; section of cortex. *a*. Malpighian tuft some
Thickened capsule of Bowman. *c*. Tubule somewhat compressed
compressed, with lumen obliterated. (PURDY.)

goes contraction, so that the surface of the organ becomes uneven, and its capsule cannot be stripped off without lacerating the subjacent tissues. This form of contraction may be distinguished from the contraction which takes place as a primary disease, by the greater prominence of the nodules upon the renal surface, and by the fact that cysts are rarely formed within its substance. The yellow color of the organ also distinguishes it from the red, primary contracted kidney.

SYMPTOMS. *Chronic parenchymatous nephritis* often begins with all the symptoms of acute nephritis and gradually subsides into a chronic form; but, usually, the disease commences insidiously. *Dropsy* is often one of the earliest symptoms that attract attention, and it reaches a greater degree of development than in acute nephritis; the *skin* becomes pale, *digestive disorders* interfere with the nutrition of the patient, *dyspnœa* and *palpitation* occasion distress, *death* sometimes suddenly follows asphyxia or œdema of the lungs or glottis.

FIG. 136.



Hyaline, or waxy casts. *a*. From a case of chronic Bright's disease of eight months' duration. *b*. From a case of chronic Bright's disease (large white kidney). *c*. From a case of chronic Bright's disease (contracted kidney, with fatty degeneration). (ROBERTS.)

The *amount of urine* is greatly diminished, and it is frequently turbid with urates; the specific gravity is increased, and a large amount of albumin is present, sometimes exceeding half an ounce each day. The *urinary sediment* contains hyaline, granular, and waxy casts, minute oil globules, and cells from the tubules which have undergone fatty degeneration. (Fig. 136.) Red blood-corpuscles and round cells are sometimes present. Chloride of sodium, phosphoric acid, and kreatinin are diminished in amount.

The *pulse* is usually small and weak. *Hypertrophy of the heart* occurs less frequently than in chronic interstitial nephritis.

The *temperature* of the body usually remains normal. The *retina* is less frequently inflamed than in cases of interstitial nephritis. The

and its morbid constituents are diminished, but the
dilatation and hypertrophy. The left ventricle is esp
this change, but the right side also participates at a late

Diagnosis. The recognition of *chronic parenchyn*
is frequently attended with difficulty, and from the *ar*
cannot be distinguished by the symptoms, unless evide
degeneration are apparent in other organs. *Acute ne*
entiated by its rapid course, acute symptoms, and lesser d
Chronic interstitial nephritis is distinguished by the
œdema, by the increased quantity of urine of a low
and by the absence of albuminuria. Interstitial nephr
frequently associated with hypertrophy and dilatatio
inflammation of the retina, uræmia, and cerebral hemo
the kidneys have undergone *secondary contraction* thei
be differentiated from primary chronic interstitial infl
kidney by the occurrence of dropsy during the earl
disease, by the normal quantity of the urine, which e
gravity of about 1010, and by the presence of albu
morbid constituents, among which the evidences of fa
are conspicuous.

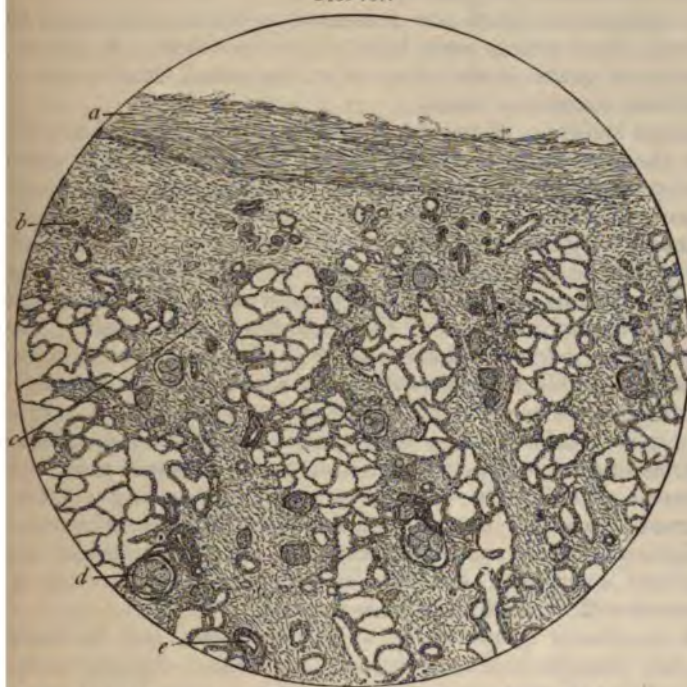
Prognosis and Treatment. The *prognosis* is alw
The *treatment* corresponds very nearly with that which
mended in cases of acute nephritis. A milk diet, warm
diaphoresis, and the use of citrate of potassium as a
all the relief that can be expected in the majority of c

Chronic Interstitial Nephritis—Nephritis Interstit

Etiology. The primary form of *chronic interstiti*
be considered as one of the diseases of old age. It is
tered after the fortieth year of life; more commonly a
among women, especially among those who are exposed

renal arteries and their branches are involved. The glomeruli ve less blood; the tubuli uriniferi become obstructed, and trans- ed into cysts, so that the kidney appears as if invaded by cystic rths. The interstitial connective tissue undergoes comparatively t change. The organ appears diminished in size, and its surface mes nodulated, but the tissues are less resistant than in cases of nary renal contraction. The cortical portion is greatly reduced. *genuine primary contracted kidney* is frequently surrounded by a

FIG. 137.



hosis of the kidney; longitudinal section of the cortex, including capsule. *a*. ened capsule. *b*. Compressed tubule, nearly obliterated. *c*. Wedge-shaped band of tissue extending inward from capsule. *d*. Malpighian tuft somewhat compressed. ion of artery, showing thickened coats. (PURDY.)

derable amount of fat; its capsule appears more or less generally ened and adherent to the renal parenchyma; its bloodvessels are greatly dilated. The kidneys themselves are very small, sometimes han half the ordinary size and weight of the organ. The surface nts a dark-red color, and is granular and nodulated, in conse- ce of irregular contraction of the connective tissue. The breadth e cortical portion is exceedingly reduced, though the medullary on presents less evidence of diminution. The renal infundibula pelvis are dilated, and frequently exhibit the evidences of catarrhal nmation.

icroscopical examination reveals great increase in the interstitial

arteriole is frequently hypertrophied.

The appearances which are presented by the so-call agree with those which have been above described. infiltration of urates is also observed in the tubuli uri intertubular connective tissue.

Changes similar to those which are observed in the r invade the other arteries of the body. The *heart* u dilatation and hypertrophy; the *endocardium* and t also become extremely liable to inflammation or deg *pleuræ* and the *pulmonary organs* are frequently inflam *dial sac* and the *gastro-intestinal canal* are often affect tion, and *cirrhosis of the liver* is a common event. *M* and *thickening of the bones of the skull* are not uncom *hemorrhage* or *œdema*, and *anæmia of the brain* have

SYMPTOMS. *Chronic interstitial nephritis* frequentl with symptoms of so trifling a character that the disea nized by its termination, or after death. Frequentl symptoms of cardiac hypertrophy, or of gastro-intestin occurrence of failure in eyesight or hearing, bleedi hoarseness, headache, thirst, polyuria, epileptiform co neuralgia, or chronic rheumatic pains, are the only sy the patient complains; and only on examination of t connection with renal disease made apparent.

The *prominent symptoms* by which the disease m are three: changes in the *character of the urine;* cha *dition of the circulatory apparatus;* and changes i *vision.*

The *quantity of the urine* is greatly increased, and is voided at night is greater than the portion voided Only in the later stages, when the heart begins to f renal structure is nearly consumed, is the amount of u The color is yellow, the liquid froths easily by reaso

ercentage of urinary constituents is almost always reduced, though ıcreased quantity of urine may keep the total balance good. times the amount of *urea* is greatly diminished, and occasionally xcreted through the medium of the perspiration, appearing upon ırface of the skin in the form of a frosty deposit. The other ry constituents are also diminished in quantity.

latation and hypertrophy of the heart are very common occurrences. *ulse* is hard and wiry in consequence of the increased tension that oduced by hypertrophy of the left ventricle. Palpitation of the or determination of blood to the head, epistaxis, and cerebral rrhage are not uncommon consequences of cardiac changes.

e connection between inflammation of the kidneys and *hypertrophy e heart* is very certain, yet its causes are not thoroughly under- . It has been attributed to the increased resistance that is sup- to follow the occlusion of so considerable an arterial territory as enal circulation; but cardiac hypertrophy does not follow amputa- f a limb. Hypertrophy of the heart is probably the result of the tion of urinary constituents in the blood, by which the cardiac le undergoes irritation and modification of structure.

tention is frequently directed to the *changes within the eye* by the rence of ocular disturbances, such as amblyopia, flashes of light e the eyes, and sensations as if objects were distorted or seen gh a fog. Temporary loss of vision sometimes occurs, and appears dependent upon uræmic poisoning of the central nervous system. retina undergoes fatty degeneration and sclerosis—changes which ot pathognomonic of interstitial inflammation of the kidneys, since are also observed in certain cases of acute and chronic paren- atous nephritis, and in connection with amyloid degeneration of idneys, as well as in other diseases. Even in chronic interstitial ritis it only occurs in about seven per cent. of the cases. Its ex- e is, however, an exceedingly valuable symptom which should t attention to the kidneys, even though albumin be absent from rine.

hthalmoscopic examination reveals chronic retinitis; the retina its yellow spots, especially in the vicinity of the macula lutea and e optic papilla; the larger patches are dependent upon fatty de- ation in the layers of the retina, while the smaller, especially those e vicinity of the macula lutea, are caused by sclerotic changes in erve fibres. In many cases the optic papilla presents the appear- of a choked disk which precisely resembles the choked disk that in cases of cerebral tumor or other diseases. The papilla is inent, swollen, and red; the retinal veins are dilated and tortuous, the retinal arteries are reduced in size. In certain cases hemor- c effusions are visible in the vicinity of the larger retinal vessels; y their absorption they originate white patches which must not be unded with the sclerotic or fatty portions of the retina. The ı of these patches is associated with the alteration which the con- ion of the blood has undergone, by which the retinal vessels lose ower of retaining their contents. Œdema and proliferation of the

connective tissue, involving the sheath and trunk of the optic nerve, are sufficient to explain the existence of choked disk.

During the course of chronic interstitial nephritis the other organs of the body exhibit evidence of disorder; the *skin* becomes very pale, thin, and dry, and perspiration is greatly reduced; in certain cases intolerable itching, or obstinate eczema may occur; the *muscular system* becomes enfeebled; the *appetite* fails, though thirst is increased; *sleep* is disturbed by the frequent necessity for the passage of urine; *eructation* or *vomiting* are not uncommon, especially when the phenomena of uræmia are developed; the *bowels* become constipated, though, in consequence of uræmia, severe diarrhœa or hemorrhage from the intestines may be developed; the *pulmonary organs* exhibit an excessive tendency to inflammatory diseases; *sexual desire* disappears.

Chronic interstitial nephritis may continue for many years. *Death from uræmia* is more common than in any other form of Bright's disease. Inflammations of the serous membranes, to which the renal disease creates a predisposition, are frequently fatal, and cerebral hemorrhage is not an uncommon event. Recovery rarely occurs.

Diagnosis. From other forms of renal inflammation, *interstitial nephritis* may be differentiated by the copious discharge of urine with a low specific gravity, scanty sediment, very little albumin, and by the rare occurrence of hæmaturia or œdema. It is often difficult to distinguish this form of nephritis from *amyloid degeneration of the kidneys*, unless evidences of amyloid degeneration in other organs are also present.

Prognosis and Treatment. The *prognosis* is always unfavorable. The *treatment* should be continued in accordance with the rules laid down for the treatment of acute and chronic parenchymatous nephritis. If gout, syphilis, malarial cachexia, or chronic suppuration exist in connection with the renal disease, they require their own appropriate treatment. Iodide of potassium is frequently administered with the hope of cure, but very little advantage beyond its diuretic influence can be expected.

Uræmia.

Etiology. *Uræmia* signifies that association of symptoms which may follow every considerable interference with the excretion of the urinary constituents. In cases which are accompanied by a copious discharge of urine, it is probable that the urinary constituents have been for a long time previously retained in the tissues, and that the excess of urine and the phenomena of uræmia are alike dependent upon their sudden and excessive liberation.

Uræmia occurs most frequently during the course of Bright's disease, especially when that assumes the form of *chronic interstitial nephritis*. It is less common in cases of acute nephritis, and is most rarely observed in chronic parenchymatous nephritis. It is more frequently developed after scarlet fever than after diphtheria. It is a very common complication of cholera and pregnancy. It also occurs in connection with diseases which obstruct the urinary passages, especially when the urine undergoes decomposition in the bladder, and the ammoniacal product is

bsorbed. Strictures and tumors which occlude the ureters or other nary passages may thus give rise to uræmia. It is therefore not an common incident in the course of infective diseases, or in paralytic ditions of the bladder which are dependent upon spinal diseases.

The theory of the dependence of uræmia upon the mechanical causes, h as compression of the capillaries and veins, by which cerebral ema and anæmia are produced, is now generally abandoned. For a siderable time uræmia has been ascribed to the retention and decomsition of urea in the blood and tissues, where ammonia is supposed to set free, and to excite uræmic symptoms. This theory is based on the well-known poisonous effects of carbonate of ammonia, and on the ammoniacal smell which is often perceived in the breath of emic patients. By certain authors the hypothesis was maintained t urea underwent excretion through the gastro-intestinal mucous mbrane, and was there decomposed, liberating ammonia which was n reabsorbed, with consequent symptoms of ammoniacal poisoning. the present time it is believed that not only the reabsorption of erated ammonia, but also the retention of other urinary constituents, reatinin, ptomaïnes, leukomaïnes, etc.), give occasion for the develop-nt of uræmic symptoms. It has also been suggested that uræmia is veloped not only by reason of the absorption of the ammoniacal prodts of urinary decomposition in the diseased bladder, but that it is o dependent upon the coincident absorption of bacteria and their oducts which flourish in great quantities within the inflamed organ. elapses are frequent. The disorder frequently develops suddenly, or may be preceded by various *nervous symptoms*, such as headache or zziness. So common is this connection that all cases of frequent headhe should awaken a suspicion of renal disease. Trigeminal neuralgia frequently occasioned by uræmia; sometimes other forms of neuralgia e also dependent upon the same cause. Anæsthesia, paræsthesia, d muscular spasms or epileptiform convulsions frequently occur as a nsequence of uræmia. Occasionally, paralytic affections of a tranent character are observed. Aphasia and muscular tremor have been ticed. Frequently, consciousness is lost; the patient appears somnont or comatose, lying in an unconscious condition with irregular respiran, and involuntary evacuation of urine and feces; sometimes consciousss disappears only during the occurrence of epileptiform convulsions; metimes delirium and maniacal symptoms appear, and other symptoms mental derangement have been occasionally observed. In certain es *total blindness* may suddenly occur, may persist for several days, l then as completely disappear; the cause of this phenomenon is not pendent upon any visible changes in the ocular structures; it is probly associated with functional changes in the cerebral centres. The pils of the eyes are frequently contracted. The *sense of hearing* is o involved, and voices, bells, music, and various other sounds become lible; a certain amount of deafness is not uncommon. *Hemorrhages m the mucous surfaces* of the body, vomiting and dysenteric diarrhœa en occur. The *œdematous condition of the respiratory mucous membrane* sometimes originates obstinate hoarseness or the occurrence of hmatic paroxysms. Sometimes œdema of the lungs, or of the glottis,

or inflammatory conditions of the pulmonary organs are developed. The *serous membranes* of the body, especially the pleuræ, sometimes become inflamed.

In connection with uræmia the constituents of the urine are generally reduced in amount. Sometimes the termination of the uræmic paroxysm is accompanied by an unusually abundant discharge of renal casts, as if the urinary tubules had been suddenly relieved from obstruction. In certain instances the skin affords vicarious relief, and urea is deposited like frost-work upon the hair, and upon the surface of the body. Not unfrequently the cutaneous nerves are greatly irritated, and there is complaint of insufferable itching.

The *course of uræmia* manifests a marked tendency to reduction of the bodily temperature, though occasionally its increase has been known. The pulse becomes small and weak, and is frequently retarded.

Uræmia is often preceded by minor forms of functional derangement, and it sometimes is developed suddenly in persons of apparently sound health; in such cases a sudden convulsion, or an apoplectic attack, may be the first indication of any departure from the normal condition; in other cases, it appears during the course of chronic renal diseases, after exposure to some cause by which the excretion of the urinary constituents has been impeded. Sometimes it follows copious perspiration, or the rapid disappearance of dropsical symptoms; in such cases uræmic poisoning is due to the rapid return to the blood of excrementitious substances which had been harmlessly stored up in the tissues or in the dropsical transudation.

Diagnosis. For the recognition of uræmia it is necessary to study its causes and to investigate the condition of the urine, in order to differentiate the disorder from the numerous cerebral, nervous, and miscellaneous diseases which are attended by pain, delirium, convulsions, and coma.

Prognosis and Treatment. The *prognosis* is always serious. *Prophylactic treatment* is of the greatest importance. All patients who suffer with renal disease should be cautioned against the consequences of reduction in the amount and quality of the urine.

The outbreak of uræmic symptoms must be met by the administration of remedies which promote the discharge of urine and neutralize the ammoniacal products that result from the decomposition of urea. For this purpose large quantities of strong lemonade should be administered, and salicylic acid, benzoic acid, and other drugs which favor the elimination of urea must be prescribed. If the pulse indicates cardiac debility, a tablespoonful of the infusion of digitalis with a scruple of the citrate of potassium should be given every two hours; if this be insufficient to support the failing heart, half a drachm of a 10 per cent. solution of camphor in almond oil may be given hypodermically, three times a day. Ether, musk, and capsicum are also useful. *Active diuretics* accomplish little, since the kidneys are usually unable to respond to their action. It is better to arouse the vicarious action of the skin and of the alimentary canal than to over-stimulate the renal apparatus. The compound infusion of senna with sulphate of sodium, or sulphate of magnesium, may be given in sufficient quantity to produce

e or six copious watery stools each day. Colocynth sometimes pro-
ces a similar good result. *Diaphoretics* should be employed with a
rtain degree of caution, since uræmia sometimes follows excessive per-
ration. Pilocarpine produces an excellent result if it does not act
favorably upon the heart. Hot air baths are always beneficial; hot
ter baths, followed by continued sweating under blankets in bed, are
great service, though at first it may be difficult to excite perspiration
these methods; after their repetition, sweat flows more easily.
The occurrence of epileptiform convulsions requires the administra-
n of chloroform; chloral hydrate, in doses of 40 grains, also affords
eat relief. For puerperal eclampsia and cases of uræmia attended
a full and bounding pulse, venesection is strongly recommended.
æmic asthma is promptly relieved by the hypodermic injection of
orphine.

Renal Abscess—Nephritis Suppurativa.

ETIOLOGY. *Suppurative inflammation of the kidneys* is dependent
on their invasion by the various forms of bacteria that excite inflam-
ation. These microörganisms find access to the kidneys through the
oodvessels or through the urinary passages. In this way ulcerative
docarditis may be followed by the passage of cocci from the heart to the
dneys. Puerperal inflammation and other septic, pyæmic, or infective
ocesses may, in like manner, lead to suppuration and to the forma-
on of abscesses in the kidneys. In another class of cases, the inflam-
atory process originates in the urethra, or in the bladder, or in the
eters, or in the pelves of the kidneys, and the renal tissue becomes
fected by the ascent of microörganisms from below, either directly
rough the urinary passages, or indirectly through the blood and
mph vessels.
Abscesses and other suppurative processes in the vicinity of the
dneys, sometimes, produce renal inflammation by extension of the
imary disease; but in certain cases it is impossible to distinguish the
iginal process from the resulting renal inflammation.
PATHOLOGICAL ANATOMY. In many instances the size of the
dney remains unchanged; its *capsule* at various points is adherent to
e subjacent parenchyma; the *cortical portion* is occupied by numer-
s minute gray points that are surrounded by a hyperæmic zone;
the *medullary portion* similar changes appear in the form of striæ
ich lie parallel with the tubular structures. *Microscopical exami-
tion* exhibits numerous embolic obstructions in the bloodvessels;
e emboli consist chiefly of microörganisms that occupy the glomeruli
d the intertubular capillaries; around these are numerous round
ls that accumulate and become associated with pus corpuscles; the
ular epithelium swells and undergoes coagulative necrosis; the
ules themselves are frequently occluded by clusters of micrococci;
this way minute miliary abscesses are formed which may become
fluent, thus producing larger depots of pus that may finally involve
e entire kidney.
Renal abscesses sometimes present considerable magnitude. In cer-
n cases rupture takes place into the pelvis of the kidney, and pus

escapes through the ureter into the bladder; in other cases the abscess may rupture into the peritoneal cavity, or into the alimentary canal, or behind the peritoneal sac, or into the thorax. Occasionally an external discharge through the abdominal wall takes place; sometimes its purulent contents undergo caseation and calcification, and the kidney becomes deformed by the contraction of cicatricial tissue.

SYMPTOMS AND DIAGNOSIS. The recognition of *suppurative nephritis* is often impossible. Even the occurrence of albuminuria may frequently be explained by the infective diseases that underlie the suppurative process. When dependent upon injuries, there is complaint of *pain in the loins*, and the cremaster muscle is often spasmodically contracted; the patient is compelled to lie in the position that is accompanied by the least pain; *feverish symptoms* frequently occur; *diuresis* and *hæmaturia* are not uncommon; in many instances, especially after injuries, the symptoms of *purulent nephritis* are so intimately associated with those which are dependent upon the injury that they escape separate recognition. The occurrence of a *fluctuating renal tumor* is not an unfrequent event; but it may also be caused by echinococci, or by some neoplastic growth. The swelling may be differentiated from *tumors of the liver or spleen* by its non-participation in the movements of respiration. Pus in the urine, though frequently due to renal abscess, may also proceed from suppuration of the renal pelvis or from the urinary passages. The presence of renal casts favors the hypothesis of renal suppuration, though they afford no certain indication. The presence of renal débris in the urine is a valuable indication, but it is a very rare event. Sometimes the rupture of a renal abscess in other directions first affords the indications for diagnosis.

The duration of the disease is sometimes very considerable. *Death* results from exhaustion, or from septic or uræmic conditions, or from peritonitis.

PROGNOSIS AND TREATMENT. The *prognosis* is always very grave, and the *treatment* must be conducted in accordance with the rules of surgery.

Amyloid Kidney—Ren Amyloideus.

ETIOLOGY. *Amyloid degeneration of the kidneys* is dependent upon the same causes that produce similar degeneration in other organs. The disease occurs more frequently among males than among females.

PATHOLOGICAL ANATOMY.—*Amyloid degeneration* seldom occurs as an uncomplicated renal disease. It is generally associated with chronic parenchymatous inflammation, or with chronic interstitial nephritis. In its early stage it may be recognized by the aid of the microscope, but at an advanced period the degenerated tissue may become visible to the naked eye and can be easily demonstrated by its reaction with iodine.

The *affected glomeruli* appear like gray, translucent granules which exhibit a mahogany-brown color on treatment with iodine. The *kidney* appears enlarged and increased in weight. The *capsule* may be easily stripped off; its surface is smooth and pale, and the *stellate vessels* are

ected; on incision the surface appears pale and waxy, and the asity of the organ is increased. The breadth of the cortical portion considerably increased, while the medullary portion exhibits little ange in color or volume.

Microscopical examination shows changes in the glomeruli; they pear enlarged, thickened, and more homogeneous in structure than ual. The epithelial cells and their nuclei disappear in proportion to e extent of the degenerative process. The afferent and efferent ves- ls are next invaded; at a later period the interlobular capillaries, d, finally, the medullary capillaries undergo degeneration; the urin- rous tubules are also invaded, and their epithelial cells participate in e general process.

Along with the degenerative changes above described, *inflammatory ocesses* of an interstitial or parenchymatous type are usually asso- ated; the liver, the spleen, the intestine, and many other organs of e body are almost always simultaneously invaded by the amyloid pro- ss.

SYMPTOMS. The association of amyloid degeneration with inflam- atory forms of renal disease renders it impossible, in many cases, to stinguish between the symptoms of the one or the other form of renal sorder. In certain cases albuminuria may be absent, though the kid- ys have undergone extensive degeneration. Dropsy is not always esent, consequently the existence of the disease can be inferred, metimes, only from the history and cachectic condition of the patient.

But, as a general rule, the *urine* is considerably diminished in quan- ty; it is pale, acid, and of a low specific gravity, varying between 010 and 1015. In the scanty *sediment* may be found slender hyaline sts to which are frequently adherent oil globules, round cells, or bular epithelium which has sometimes undergone fatty degeneration. certain cases waxy casts that exhibit the characteristic reaction with dine, may be observed. Red corpuscles are sometimes present. lbumin appears in considerable quantity. Of the other urinary nstituents, phosphoric acid alone is diminished. Indican is present considerable amount.

Dropsy is a very common occurrence. The *skin* exhibits excessive llor; the *temperature* and the *pulse* remain without change. Diseases the *respiratory apparatus* are exceedingly common, and the *alimen- ry canal* is often the seat of ulceration and of profuse diarrhœa. The *tina* and the *circulatory apparatus* are sometimes involved.

The *duration of the disease* is exceedingly variable, and is depend- t upon its underlying causes. *Death* almost always is the result, ough recovery has been occasionally reported. Death is usually used by uræmia or by inflammation of the serous membranes or of lungs. In the majority of cases life is terminated by exhaustion. many cases the concomitant forms of Bright's disease furnish the edominant symptoms and determine the mode of death.

DIAGNOSIS. The diagnosis of *amyloid degeneration* is impossible the absence of albuminuria. In every event, it is largely dependent on the recognition of amyloid degeneration in the liver and spleen. om *acute and chronic parenchymatous nephritis* it may be differen-

Fatty infiltration of the kidneys is associated wi
fat in the food, and with the existence of obesity.
of the kidneys frequently results from previous infla
in the chronic parenchymatous form of Bright's dise
diseases that predispose to fatty degeneration. It
the inhalation of coal gas, or poisoning with pl
antimony, chromium, and the mineral acids.

Embolic Infarction of the Kidney

Renal infarction is usually caused by the obstru
vessel with an embolus derived from the heart.
involved more frequently than the right, because th
forms with the aorta a more acute angle than the rig
the trunk of the renal artery may be followed by
the entire kidney; but in the majority of instances
twigs within the organ are the seats of obstructi
infarcts exist, the *white* and the *red infarct*. Both
or wedge-like form, with the base of the cone direc
face of the kidney. *The white infarcts* are characte
condition of the tissues. The epithelial cells of th
condition of coagulative necrosis. The peripher
rounded by a hemorrhagic zone. *Hemorrhagic*
frequently observed. They present a dark-purple
are finally transformed into a gray or yellow chees
degeneration and absorption are followed by contra
cial tissue, so that sometimes, when numerous infarc
the kidney presents a nodulated surface. Other i
renal circulation may also lead to the producti

of a reddish powder, which consists chiefly of urates that have precipitated within the uriniferous tubules. (Figs. 138, 139). ame canals in adult life are sometimes occupied by similar

FIG. 138.



Hedgehog crystals of urate of soda spontaneously deposited from the urine of a child. (ROBERTS.)

FIG. 139.



Amorphous urate deposit. (ROBERTS.)

FIG. 140.



stallized phosphate of lime. Selected to show various forms. (FINLAYSON.)



Oxalate of lime crystals. Selected to show various forms.

sometimes followed by a deposit of calcium carbon
tubules. In certain cases the tubules are obstructed
hæmatoidin.

Cancer of the Kidney—Carcinoma Ren

ETIOLOGY. *Renal cancer* may be either primary o
a *secondary disease* it results from primary cancerous
organs of the body. As a *primary disease* it genera
any apparent cause. Sometimes it is preceded by in
culi in the kidneys. It is observed in certain cas
disease. It is more frequent among men than amo
generally encountered at the extremes of life. W
exerts any influence upon its recurrence is unknown.

PATHOLOGICAL ANATOMY. *Secondary cancer* co
both kidneys, but *the primary disease* usually attac
that, more frequently, the right kidney. Secondary
occurs in the form of circumscribed masses, while pr
vades the entire kidney. All varieties of the disease ma

Renal cancers develop first in the epithelial structu
The resulting tumors may reach great size, occupying
of the abdomen. The consistence of the tumor depe

MS. *Renal cancer* often remains unrecognized during life, when the primary disease is located elsewhere and masks the that arise in the kidneys. Sometimes the development of nd progressive emaciation are the principal symptoms. In s, severe forms of *neuralgia* in the lower half of the body are the most conspicuous phenomena; and, again, the first nay be afforded by a violent attack of *hæmaturia*.

st certain indications of renal cancer consist in the develop- *renal tumor* and of *hæmaturia*. (Fig. 142). A very charac- mptom is afforded by the iversal *presence of the colon* he anterior surface of the the abdominal wall. Some- can only be observed when is filled with air. That the ot connected with either the e spleen is demonstrated by rticipation in the movements tion. It is usually nodu- itive, and resistant to pres- gh sometimes fluctuation can ished at certain points upon . Puncture of the tumor ch circumstances yields a bloody liquid which contains aric acid. Pulsation, which arefully distinguished from aneurism, is sometimes per-

Fig. 142.



Renal cancer. (Rush Medical College Clinic.)

uria, though a frequent, is iversal symptom of renal The urine contains blood in quantities, and sometimes sts of the ureters are visible. They are often voided with le pain and interference with the discharge of urine. In cer- detached fragments of the cancerous growth obstruct the assages, and if they be voided with urine their specific charac- e recognized by the aid of the microscope. In the absence of a the urine presents nothing remarkable. Albumin is only hen the kidneys are themselves inflamed or undergoing amy- eration.

the less characteristic symptoms are pain in the loins and in the the nerves which originate from the lower part of the spinal ogressive emaciation and cachexia are developed. Insomnia common, and disturbances of the alimentary canal are fre- bserved.

erage duration of the disease is about one year; death some- urs suddenly as the consequence of hemorrhage. In other sults from progressive wasting, dropsy, diarrhœa, peritonitis, a.

DIAGNOSIS. Without the recognition of a tumor the diagnosis of renal cancer must necessarily be very obscure, and often after the discovery of a tumor it is not always easy to distinguish it from tumors of the liver, spleen, stomach, pancreas, intestines, mesentery, abdominal glands, ovarian cysts, aneurisms, and psoas abscesses. From *tumors of the liver* and *spleen*, a renal tumor may generally be differentiated by the absence of movement in harmony with the respiratory excursions of the diaphragm. *Gastric and intestinal tumors* may be suspected when gastro-intestinal symptoms are present, and when the distention of the stomach and intestines with air causes displacement of the tumor. *Fecal tumors* may be suspected when their discovery has been preceded by a long-continued constipation. *Ovarian tumors* spring from the pelvic region and lie close to the abdominal wall, while *renal tumors* are generally separated from it by the colon. *Psoas abscess* is characterized by a greater amount of pain and by constant flexion and abduction of the thigh. *Aneurismal tumors* may be recognized by their peculiar pulsation and by the retardation of the crural pulse.

Renal carcinoma cannot be differentiated during life from *renal sarcoma*, and it is very difficult to distinguish it from renal cysts, echinococci, or abscesses. *Renal tuberculosis* may be distinguished by the presence of tubercle bacilli in the urinary sediment. The concurrence of a renal tumor and hæmaturia affords strong evidence in favor of cancerous disease.

PROGNOSIS AND TREATMENT. The *prognosis* is bad. Medical *treatment* must be purely symptomatic. For the results of surgical interference the student is referred to the text-books on surgery.

Sarcoma, adenoma, fibroma, carcinoma, lymphangioma, myxoma, glioma, and lipoma, have all been described among tumors involving the kidneys. The echinococcus parasite may develop in the kidneys and may produce tumors of great size which are very difficult to distinguish from other renal tumors.

Renal Cysts—Hydrops Renum Cysticus.

Renal cysts may be either congenital or acquired. The *congenital cysts* are often very numerous and develop to such a size that delivery becomes impossible without embryotomy. The contents of the cyst are a clear, transparent liquid which contains albumin, cholesterine, urates, carbonates, and phosphates. Urea is absent. Other deformities dependent upon imperfect development are not unfrequently observed. *Acquired cysts* sometimes represent a later development of rudimentary congenital cysts; in other instances they are the result of injuries by which the uriniferous tubules have become obstructed and consequently dilated. Not unfrequently the occurrence of urinary calculi is associated with the formation of renal cysts through obstruction of the minute passages within the kidneys. The dimensions of a cyst are sometimes very great, so that the kidney may be converted into a mass weighing several pounds. By the confluence of a number of cysts a many-chambered cavity may be formed in which distinct

pta are visible. The contents are usually thin and watery, but occa-nally they exhibit a colloid character, or may be tinged with blood. ie microscope indicates the presence of epithelial and round cells, l blood-corpuscles, cholesterine tablets, triple phosphates, and various rms of detritus. Urea and uric acid are generally absent, while icin and tyrosin are often present. Medical treatment affords no rmanent relief, and surgical measures are almost equally fruitless.

Movable Kidney—Ren Mobilis.

ETIOLOGY. In about eighty-six per cent. of the cases of *movable dney* the right kidney is involved. Both organs are occasionally splaced. In eighty or ninety per cent. of the cases the sufferers ere females. The disorder is generally originated between the enty-fifth and fortieth years of life. It is sometimes caused by juries or falls, or by excessive muscular exertion; it may result in e course of violent coughing, straining, or parturition. Less clearly pparent is the connection between wandering kidney and various ner-ous disturbances and diseases which have been assigned as causes of ie difficulty. In certain cases it results from increase in the size and eight of the kidney, or from enfeebled and emaciated conditions by hich the natural supports of the organ are reduced in quantity and fficiency.

SYMPTOMS. A movable condition of the kidney frequently escapes no-ice, or is first suddenly observed in connection with some unusual move-ent or position of the body. The degree of mobility presents great ariations; sometimes the kidney may fall as low as the pelvis, where presents a tumor of renal form, tender on pressure, and connected ith the pulsating renal artery. Sometimes the empty socket from hich the kidney has escaped yields a tympanitic sound on percussion. certain cases polyuria is observed so long as the kidney remains dis-cated. Not unfrequently paroxysms of severe pain are experienced. omiting, shivering, cold perspiration, and reduction in the amount of ine, are observed. Sometimes there is blood or pus in the urine. hese paroxysms are supposed to depend upon incarceration of the dney, or upon torsion of its pedicle. In certain instances the par-ysms are probably dependent upon local inflammation, or upon ob-ruction in the course of the ureter.

Various hysterical disturbances which are liable to aggravation uring the menstrual period, are frequently observed. Sometimes undice is produced by pressure upon the common bile-duct; or dila-tion of the stomach may originate from compression of the duodenum. ccasionally paraplegic symptoms are produced by pressure upon the rves that lead to the lower extremities. In the same way œdema ay arise from venous compression.

DIAGNOSIS AND TREATMENT. It is not always easy to distinguish wandering kidney from other abdominal tumors, unless it can be ognized by its form and by the pulsation of its artery. If any ediable cause for displacement of the kidney exists, *treatment* uld be directed to that condition. Improvement of the general

In certain cases the two kidneys become more or
coalescent by their inferior extremities. Their pelv
bloodvessels, in such cases, usually present notable dep
ordinary type. The peculiarity can seldom be demo
life, though sometimes in slender persons, a tumor l
aorta may be demonstrated in the posterior portion o
cavity. Occasionally, uræmic symptoms, or thrombosi
vena cava, may be produced by its pressure.

Absence of the kidney and the **presence of supe**
have been described in certain rare instances, but th
dents possess no clinical importance.

Para-Nephritis.

ETIOLOGY. *Para-nephritis* is an inflammation of t
tive tissue which surrounds the kidney, behind the perit
renal pelvis is placed. Consequently, the disease is c
previous inflammation in that portion of the urinary
sometimes, however, excited by injuries, by exposure t
propagation of inflammation from the kidneys or urina
the para-nephritic connective tissue. It sometimes fo
upon the pelvic organs or urethra. It may result fro
from tubercular disease of the spinal column, or from i
eases involving any of the abdominal or thoracic orga
tive diseases may also operate as exciting causes of th
but sometimes no definite cause can be assigned for its

Para-nephritis occurs more than twice as often amon
women; it is usually encountered between the twenti
years of life, though it is sometimes observed among yo

usion may become caseated; and this transformation is accompanied
the development of cicatricial contractions which sometimes encroach
riously upon the kidneys, or upon the portal vein. In the majority
cases, however, pus finds its way through the loins to the surface, or
burrows into the thorax, or effects an entrance into the peritoneum or
to the cavities of the abdominal and pelvic organs.

SYMPTOMS. *Para-nephritis* sometimes develops in a very insidious
anner; in other cases it is ushered in by the symptoms of high fever
d severe pain in the loins. The principal symptoms of the disease
e *fever*, *pain*, and the devopment of a *tumor* in the region of the kid-
ys. Pressure over the seat of inflammation increases the sensation of
in; sometimes the suffering presents an intermittent character like
at of neuralgia. Occasionally it extends to the pelvis and thighs.
s the disease progresses, swelling can be frequently discerned in the
ins, especially when the patient stands erect. The skin becomes
nooth, shining, hot, and red; finally fluctuation may be distinguished.

In the majority of cases the patient is compelled to lie in a position
at will relax the tension of the inflamed parts. *Fever* is present,
onstipation is often produced by compression of the colon, and *dyspnœa*
esults from interference with the movements of the diaphragm. The
rine ordinarily presents no particular alteration, though albuminuria
sometimes observed as a consequence of compression of the renal
eins.

Spontaneous resorption of the pus is not to be expected. The *course*
the disease may continue for three or four weeks, if proper surgical
eatment is employed; but, if left to itself, it may continue for many
onths. Spontaneous evacuation of pus may occur upon the external
rface of the body, or a communication may be effected with the
imentary canal, or the renal passages. Perforation of the peritoneal
vity is the most dangerous sequel, though death frequently results
m the penetration of pus into the other organs of the body.

Amyloid degeneration is one of the complications that may follow
ra-nephritis. Sometimes *dangerous hemorrhage* follows the forma-
n of abscess. *Miliary tuberculosis* is sometimes observed as a com-
ication of the disease. Even after apparent recovery, dangerous
nsequences may follow from the contraction of cicatricial tissue.

DIAGNOSIS. *Para-nephritis* may be mistaken for *lumbago*, in which,
wever, the pain is superficial, and fever and swelling are absent.

It may be mistaken for a *superficial abscess in the loins;* but here all
e symptoms are characterized by a superficial and transitory character.

It may be distinguished from *empyema*, which is discharged through
e loins by the absence of any considerable tumefaction about the kid-
y, and by the presence of the characteristic thoracic symptoms.

It may be distinguished from *spinal tuberculosis* by the absence of
in and deformity in the spinal region.

It may be distinguished from *diseases of the kidneys and of the*
al pelvis by the presence of fever, pain, and swelling in the loins.

It may be distinguished from *inflammation of the cœcum* and its
ghborhood by the different location of the pain and swelling, and by

the absence of severe intestinal disturbances. The urine also contains a greater amount of indican.

It may be distinguished from *psoitis* by the fact that the leg and thigh upon the affected side can be extended without pain, a movement that is impossible when the muscle is inflamed.

It may be distinguished from *hip-joint disease* by the mobility of the limb, and by the absence of pain from the joint.

From *other abdominal tumors* it must be differentiated by the application of the rules which have been laid down for the diagnosis of renal cancer.

PROGNOSIS AND TREATMENT. The *prognosis* is comparatively favorable in cases which admit of early recognition and efficient surgical treatment. Much depends upon the nature of the cause by which inflammation was excited. The *treatment* rests entirely upon surgical principles. It consists chiefly in the repeated application of poultices, in the administration of narcotics for the relief of pain, and in free incision so soon as fluctuation can be detected.

DISEASES OF THE SUPRA-RENAL CAPSULES.

Addison's Disease—Morbus Addisonii.

ETIOLOGY. *Addison's disease*, first described by Thomas Addison in the year 1855, is associated with various morbid changes in the supra-renal capsules. It usually occurs between the fifteenth and fortieth years of life, though occasionally it has been encountered at an earlier or later period. It is more common among men than among women, especially among the poor. It usually involves the supra-renal capsules alone, though it has been sometimes encountered after injuries in the loins, or after exposure to great anxiety and care. In certain cases the disease is associated with tuberculosis of the lungs, or of the spinal column, or of the uro-genital organs. It has been observed also in connection with inflammatory diseases of the gastro-intestinal tract, or in connection with cancerous disease, or wasting discharges that lead to amyloid degeneration.

SYMPTOMS. *Addison's disease* is generally preceded by vague symptoms of disorder in the digestive organs, profound depression of spirits, and progressive debility. There is loss of appetite, eructation, nausea, vomiting, pain, and distention in the region of the stomach; sometimes severe diarrhœa exists; emaciation and loss of strength make rapid progress; occasionally the region of the kidneys is sensitive to pressure, and rheumatic pains are experienced in the muscles and joints. In certain cases the above-mentioned symptoms complete the picture of the disease, but, usually, changes in the color of the skin are gradually developed. This especially involves those portions of the cutaneous surface that are exposed to the air, and those regions which naturally exhibit deep pigmentation, *e. g.*, the nipples, the armpits, and the perineum. At first the skin exhibits a dirty-brown color, as if

ere not quite clean. This discoloration develops in irregular patches
gradually coalesce. In many cases the skin becomes darkly pig-
ited, like that of a mulatto or of an Indian. Old scars sometimes
ain free from pigment, but in other cases it is more abundantly de-
ited in their substance than elsewhere. In strong contrast with the
er portions of the cutaneous surface remain the palms of the hands,
soles of the feet, the nails, the teeth, and the sclerotic coats of the
s. In certain cases pigmented areas may be observed inside of the
ith, upon the inner surface of the cheeks, opposite the teeth.

The pulse is generally rapid, small, and soft, and anæmic murmurs
audible over the heart and large bloodvessels. The blood exhibits
lences of impoverishment; but the urine, though presenting great
iations in its chemical constituents, furnishes no characteristic
nges that throw any light upon the nature of the disease.

Besides the progressive disorders of digestion and nutrition which
e been already described, many nervous symptoms are frequently
erved. In addition, painful conditions of the muscles and joints,
an inclination to faintness are often exhibited. Sometimes con-
sions occur, and paralytic symptoms occasionally involve the
remities. Severe delirium and maniacal paroxysms have been
cribed.

The disease generally terminates in death in the course of a few
nths, yet in rare instances life has been prolonged for two or three
rs. Death occurs from exhaustion, or in connection with cerebral
turbances.

PATHOLOGICAL ANATOMY. Characteristic pathological changes are
erved only in the supra-renal capsules. Cancerous disease and other
ms of local degeneration are less commonly followed by the develop-
nt of the pathognomonic symptoms. Their appearance during life
hout the occurrence of local changes in the capsules which can be
nonstrated after death, forms a rare exception to the general rule.

An attempt has been made to show that the symptoms of Addison's
ease are less dependent upon pathological alterations in the supra-
nal capsules than upon morbid changes in the *sympathetic nervous*
stem. The solar plexus has been incriminated as the principal seat
disorder; but, though frequent observations have demonstrated the
istence of various disorders of nutrition and degeneration in the
nglionic cells, nerve fibres, and bloodvessels within the solar plexus,
e frequent absence of all such evidences of disease furnishes an argu-
ent against this hypothesis. In like manner, the various pathological
anges that have been noted in the spleen, liver, mesenteric glands,
l marrow of the bones, spinal cord, and elsewhere, are merely occa-
nal and accidental phenomena.

So long as the functions of the supra-renal capsules remain unknown,
must be impossible to explain their connection with any form of
ease. For this reason the *pathology of Addison's disease* is still
a most unsatisfactory condition. It is probable that the symptoms
dependent upon functional disturbances of the sympathetic nerve,
which discoloration of the skin and progressive debility are pro-
ced. This unexplained functional disorder is usually dependent

upon caseous degeneration of the supra-renal capsules; but it may be associated with local disease of the sympathetic system itself; while in a third limited class of cases, it appears to be a purely functional disorder, unassociated with any visible pathological changes. Beyond this point our knowledge at present does not extend.

DIAGNOSIS AND PROGNOSIS. The cutaneous discoloration in Addison's disease may be easily distinguished from *cyanosis* by the fact that it remains unchanged by pressure with the finger. General pigmentation after the *long-continued use of nitrate of silver* may be differentiated by the history of the case. *Severe jaundice* sometimes produces cutaneous bronzing, but in such cases the eyes exhibit a yellow stain. *Long-continued exposure to the sun* frequently produces a discoloration of the skin that is very similar to that of Addison's disease; but the absence of debility, and the history of the case should free the differential diagnosis from difficulty. The *prognosis* is always unfavorable.

TREATMENT. The treatment must be purely symptomatic.

CHAPTER III.

DISEASES OF THE RENAL PELVIS AND OF THE URETER.

Hydronephrosis.

ETIOLOGY. *Hydronephrosis* consists in the accumulation of urine within the renal pelvis and ureter, as a consequence of obstruction in the course of the urinary passages. The disease may be either the result of a congenital defect, or of a subsequent occlusion. When it is developed before birth, it frequently serves as an obstacle in the way of parturition; and if the child be delivered alive, death soon follows as a consequence of interference with the movements of the diaphragm.

Hydronephrosis in later life is generally unilateral, except in cases where the cause of obstruction operates upon both ureters. Sometimes this may result from the development, within or without the bladder, of a *tumor* which compresses both ureters at the point of their entrance into the bladder. It may also be produced by *urethral strictures*, or by aggravated *phimosis*. Obstruction of the ureter may result from the impaction of *urinary calculi*, or from *compression* by tumors or cicatricial tissues, or any other cause that may interfere with the permeability of the passage.

Hydronephrosis is more common among women than among men, by reason of the numerous pelvic diseases to which they are particularly exposed.

PATHOLOGICAL ANATOMY. *Hydronephrosis* is characterized by great dilatation of the infundibula and pelves and ureters. Sometimes the dilated ureter rivals the intestine in size, and may exhibit similar con-

utions. The renal pelvis is frequently transformed into a sac as ge as the bladder. Sometimes no traces of renal tissue can be dis-ered; but, in many instances, the kidney persists in the form of a n, flattened, placenta-like mass upon one side of the sac, and, on croscopical examination, exhibits traces of the glomeruli and urinifer-s tubules. This atrophy of the organ is gradually developed by rograde pressure through the pelvis and infundibula. The papillæ st disappear, then the medullary portion, and finally the cortical uctures of the kidney yield and disappear.

In many instances the external surface of the sac is adherent to the jacent intestines. Its inner surface resembles a serous membrane. capacity becomes enormously developed, so that its contents have en known to reach fifteen gallons. The liquid is thin, pale, and nsparent, though sometimes it exhibits a smoky color, by reason of morrhagic extravasation. Occasionally the fluid is consistent, like ly. In rare instances it becomes purulent and undergoes inspissa-n, caseation, and calcification. Microscopical examination reveals e presence of epithelial cells, round cells, colorless blood-corpuscles, ty nuclei, and tablets of cholesterine, or fragments of renal tissue. old cysts, urea and uric acid can no longer be detected.

Symptoms. The most prominent symptom of hydronephrosis con-ts in the presence of a *fluctuating tumor* which cannot be referred to y other form of renal disease, and for which the probability of occlu-n in the urinary passages exists. In severe cases the abdomen is eatly distended, and the colon can usually be discovered between the mor and the abdominal wall.

When only one kidney is involved, the other kidney may yield althy urine, but when both kidneys suffer, *uræmia and death* may ry speedily occur. Sometimes the tumor exhibits intermittent changes its size which are conditioned by variations in the degree of urinary struction that exists. The liquid contents of the sac, in such cases, ay be partly evacuated and then replaced by renewed accumulation.

As the tumor increases there is complaint of *difficult respiration*, ternal pressure, and distress, by reason of its encroachment upon the her organs of the body. Various symptoms of disturbance, such as *ver, constipation* of the bowels, *difficulty in the passage of urine*, and cal *pain*, are frequently experienced. Sometimes *hæmaturia* occurs, id rupture of the sac is often followed by *peritonitis*. *Suppuration* xcites a fever that tends to assume the hectic type, and is frequently llowed by exhaustion and death. If the sac rupture into the other tvities or organs of the body, the characteristic disturbances of such tvasion will be displayed. Sometimes the *lower limbs become œdema-us* in consequence of the pressure upon the large veins.

Diagnosis. It is often difficult to distinguish *hydronephrosis* from her renal tumors. The diagnosis must depend largely upon the monstration of a tumor coincident with obstruction to the exit of urine. he passage of hydatids with the urine, or the presence of tubercle cilli in the urinary sediment, or the existence of cachexia, would vor the diagnosis of echinococci, or renal tuberculosis, or cancer. The ease is not unfrequently confounded with ovarian tumors, or with

pregnancy, or even with ascites. Exploratory puncture for the purpose of diagnosis is attended with some risk of peritonitis, since the fluid trickles easily through such an opening into the peritoneal cavity.

PROGNOSIS AND TREATMENT. The *prognosis* is very doubtful. The *treatment* must consist largely in the attempt to remove obstructions from the urinary passages; or if this cannot be accomplished, recourse must be had to nephrotomy or to nephrectomy, though this operation is often rendered impossible by the existence of extensive adhesions.

Pyelitis.

ETIOLOGY. *Inflammation of the renal pelvis* may be either primary or secondary, acute or chronic, catarrhal, purulent, or hemorrhagic. The catarrhal and purulent forms of the disease may originate in exposure to cold, or as a consequence of injuries, or as a result of irritation of the mucous membrane of the renal pelvis by calculi, by parasites (echinococci, strongylus gigas, tubercle bacilli, etc.), or by fragments of cancerous tissue.

The most common cause of *pyelitis* is derived from *obstruction to the exit of urine*, especially when the urine has undergone decomposition and swarms with parasitic microörganisms that irritate the pelvic surface.

Pyelitis also occurs in connection with *diabetes mellitus*, or as a consequence of the excessive use of *acrid diuretics*, cantharides, oil of turpentine, and various balsams. Sometimes it follows the course of *infective diseases;* and it is often the result of *inflammation that is propagated from neighboring structures.*

Pyelitis is more frequent in middle life than in youth; among males rather than among females, especially because of the greater prevalence of renal calculi among the male sex.

PATHOLOGICAL ANATOMY. *Acute pyelitis* is characterized by redness and swelling of the mucous membrane in the renal pelvis. The epithelial surface is exfoliated and covered with a thin, slimy fluid that sometimes contains pus corpuscles. This process of exfoliation in many instances progresses until ulceration and perforation of the pelvic wall take place.

Chronic pyelitis exhibits a darker color of the mucous membrane, of which the surface is often deeply pigmented and covered by villous proliferations of the submucous tissue. At various points ulceration is evident, and the pelvic wall is generally thickened. A deposit of urates and ammonio-magnesian phosphates is not uncommon upon its inner surface. The entire cavity is frequently dilated by the operation of causes similar to those by which hydronephrosis is produced, and the renal tissue may become in like manner atrophied. Not unfrequently pyelitis and purulent nephritis are associated together, constituting *pyelo-nephritis.* The whole sac may thus become distended with pus, producing what is termed *pyo-nephritis.*

It occasionally happens that, after an entire kidney and its pelvis have been thus disorganized, the purulent contents of the resulting sac

ay become caseated and undergo calcification, while the other kidney comes hypertrophied by a compensatory increase of its function.

SYMPTOMS. *Pyelitis* sometimes remains unrecognized during life cause of the overwhelming severity of the symptoms that are con- cted with its remote cause. Its characteristic symptoms are *pain* in e region of the kidney; frequent and painful *desire to pass urine*, hich is followed by the escape of only a few drops at a time, and at- nded by great suffering. The urine, which is otherwise normal, con- ins pus and mucus. *Albumin*, in uncomplicated cases, is present in mount corresponding with the quantity of pus. The total discharge urine is considerably increased, so that many cases of polyuria may erhaps be referred to an unrecognized pyelitis.

The urine is usually very copious and contains pus corpuscles; it so contains epithelial cells from the renal pelvis, but they can be very sily confounded with similar epithelial cells from the deep layers of

FIG. 143.



Epithelial cells from the bladder, ureter, and pelvis of the kidney. (ROBERTS.)

mucous membrane of the bladder. (Fig. 143). Red blood-corpus- s are very rarely observed, except in cases where renal calculi exist. When pyelitis is complicated with hydronephrosis a renal tumor can nerally be observed. If *nephritis* also occurs, the amount of albumin the urine will exceed that which is due to the presence of pus, and ts will exist in the sediment. If *renal calculi* exist in the urinary ssages, they will occasion hemorrhages of renal colic. *Parasites* y also indicate themselves by their presence in the urine; and, if disease is dependent upon obstruction to the exit of urine the symp- ns of *chronic inflammation of the bladder* will be developed.

The *duration of the disease* depends upon its cause, and may be pro- ged for months or years.

Paraplegia or *paraparesis* are sometimes observed as consequences of

inflammation propagated from the urinary passages to the nervous system.

Pyelitis may result in complete cure, or it may produce such exhaustion, emaciation, and collapse, that death shall result as its consequence. Dropsy, suppression of urine, and uræmia sometimes occur. Paranephritis has been observed; and in certain cases the purulent contents of the renal pelvis have found their way to the surface, or have ruptured into the internal cavities and organs of the body.

DIAGNOSIS. It is often difficult to decide whether pus in the urine proceeds from the kidneys, or from a para-nephritic abscess, or from the bladder, or from other portions of the urinary tract. The existence of a tumor in the region of the kidneys renders pyelitis a probability. *Cystic inflammations* are accompanied by alkalinity of the urine. *Prostatic inflammation* is indicated by painful swelling of the gland; and *urethritis* may be recognized by its well-known symptoms.

PROGNOSIS AND TREATMENT. The *prognosis* is very unfavorable, though recovery may occur in certain cases. Every obstruction in the way of the free passage of urine should be removed, if possible. The patient should remain in bed, and his diet should consist chiefly of liquid food, especially milk and lime-water. The alkaline mineral waters may be recommended. Pain must be relieved by the hypodermic use of morphine and atropine, and poultices may be applied to the region of the kidneys. If the discharge of mucus and pus be very copious, tannic acid and opium may be administered. Sometimes acetate of lead may be employed with advantage, and the infusion of uva ursi is of considerable value. Sometimes benefit is obtained from small doses of oil of turpentine or other balsamic preparations. Tincture of cantharides, in twenty-five-drop doses, three times a day, has received favorable mention. Salol, in ten-grain doses every three hours, is also very beneficial.

In severe and chronic cases a surgical operation is often advisable for the relief of the patient.

Renal Calculi—Nephrolithiasis.

ETIOLOGY. *Calculous constituents* may be precipitated from the urine with the formation of calculi in any portion of the urinary passages. If formed in the renal infundibula or pelvis they may be transported into the ureter, into the bladder, or into the urethra. They are usually formed in the renal pelvis, from which they may work their way into the renal tissues, or in other directions. They occur, most frequently, in childhood or in old age, and are much more common among males than among females, especially among those who consume large quantities of flesh, wine, and beer. Laborious people who live much in the open air, rarely suffer in this way. In certain localities a predisposition to the occurrence of calculi seems to exist, though upon what it depends is not clearly apparent. Sometimes it depends apparently upon hereditary influences; while certain persons manifest an individual predisposition which may result in the formation of calculi on slight provocation. Cases have been known in which a few glasses

wine would be followed by the production of a renal calculus. Occaonally, injuries affecting the region of the kidneys have been followed y the formation of calculi; and diseases of the kidneys or of their pelves, especially if associated with stagnation of the urine, are specially liale to be followed by calculous disease. It also occurs frequently n connection with gout and diabetes, and in the course of osteomalacia. n these maladies the retardation of oxidation and the consequent isturbance of nutrition are common factors in the production of ric acid and oxalic acid calculi. Phosphatic gravel exists as a onsequence of inflammation in the bladder or renal pelvis, and its evelopment occurs under the influence of microörganic activity. When the lining of the bladder is inflamed, an earthy deposit ccurs upon its surface, or upon any foreign body that may be resent. In this way a uric acid nucleus may become incrusted with hosphates. If the inflammation be arrested, and the urine again be estored to its former condition, a second layer of urates may be deosited; and thus a succession of different concentric layers may be iscovered in the same calculus.

Uric acid is not deposited in healthy urine. But, if the urine be inrdinately concentrated by excessive perspiration or insufficient drink, r if the processes of oxidation be hindered in the tissues, so that an xcess of acid phosphate appears in the urine, the uric acid is prepitated, and calculi are formed. (Fig. 144.)

FIG. 144



arious forms of uric acid crystals. (Selected from OTTO FUNKE'S *Physiological Atlas.*)

PATHOLOGICAL ANATOMY. *Calculi* are generally found in only one nal pelvis, though occasionally both organs are affected. Calculous ecipitates exist either in the form of a fine, granular or crystalline wder (renal sand), or as separate, massive concretions which may ry in size from that of a grain of wheat to a mass weighing two unds. Renal sand consists chiefly of uric acid and its compounds.

Renal calculi exhibit different forms; they are usually oval or some-

what irregular in shape, though sometimes they are furnished w
numerous processes which remind one of the form of a caltrop, o
branching coral. Their density, color, and friability depend ch
upon their chemical composition. Seven varieties of renal calcul
known.

1. Calculi composed of uric acid.
2. " " " oxalate of calcium.
3. " " " phosphates.
4. " " " carbonate of calcium.
5. " " " cystin.
6. " " " xanthin.
7. " " " indigo.

In certain cases *compound calculi* exist which are composed of alte
layers of a different chemical constitution. If a calculus be laid
a nucleus at the centre may be discovered, around which the mi
matters were deposited. Sometimes parasites, or other foreign b
such as minute blood clots, have furnished the original nucleus.
deposit of mineral matter appears to take place not as a mere preci
but as an infiltration of a delicate, albuminoid framework by whic
nucleus is constituted.

Stones composed of *uric acid or of urates* are the most com
They are very hard, smooth, and polished, or sometimes slightly
ular upon the surface. They are generally composed of alternate l
of darker and lighter color. Sometimes these layers consist of alte
films of uric acid and oxalate of calcium, and sometimes the ext
surface is covered with a thin layer of earthy phosphates.

Oxalate of calcium calculi are exceedingly hard, and exhibit a
surface, from which is derived the common appellation of *mul
calculi* by which they are known. Their color is usually a dark br
and they frequently consist of alternate layers of oxalate of cal
and uric acid.

Phosphatic calculi consist usually of phosphate of calcium and
monio-magnesian phosphate. Their color is gray, and their subst
is somewhat friable.

Carbonate of calcium calculi rarely occur in the human species,
are very common among cattle. They are small, gray or brown, ea
looking concretions.

Calculi composed of cystin are very rare. Their surface is s
times smooth, sometimes rough and crystalline. Their color is a
white or amber-yellow. Occasionally they present a greenish or b
color.

Calculi composed of xanthin are also very rare. They are comp
of layers of a yellowish or brownish color.

Indigo calculus is another extremely rare formation which some
resembles in structure and appearance a fragment of indigo.

Renal calculi almost always produce inflammation of the mu
membrane of the pelvis. Occasionally this results in ulceration
which calculi may find their way into neighboring cavities or pass
The kidneys are also liable to inflammation from calcular irritation
which interstitial proliferation may be excited, or abscesses ma

rmed, so that both the kidney and its pelvis may be converted into an mense cavity filled with pus and calculous masses. Not unfrequently right's disease is associated with the formation of calculi.

If the process involves one kidney, the other may become greatly larged through compensatory hypertrophy; and if prolonged suppura- on exist, amyloid changes may be developed.

If a calculus escapes from the pelvis and finds its way into the eter, there is danger of the occlusion of that passage, and the conse- ent development of hydronephrosis. If a stone becomes impacted in e ureter, it may lead to ulceration and perforation of its walls. Other ucous inflammations may be excited along the course of the urinary act by the passage of renal calculi.

Symptoms. *Renal calculi* frequently occasion no symptoms during e, but sometimes they are unexpectedly voided with the urine without ving produced any previous pain or inconvenience.

In many cases, however, *gastric disorders* exist, such as pain, retch- g, and vomiting, which persist at intervals so long as the calculi main in the renal passages. More frequently, however, the symp- ms of *vesical catarrh* or of *pyelitis* conceal the presence of a stone. ometimes the only symptom that is presented is a repeated *hæmat- ria;* this symptom is especially valuable when associated with severe in in the region of the kidneys or along the course of the ureter. It very rarely the case that stones of a size or number sufficient to pro- ce a recognizable tumor can be found, but not unfrequently *hydro- phrosis* or *renal abscess* may have their origin in calcular obstruction.

One of the most characteristic symptoms of renal calculi is furnished the occurrence of *renal colic*, though this painful affection may be oduced by the passage of hydatids, or blood clots, or cancerous masses, other obstructions through the ureters. An attack of colic gener- y originates suddenly, either after some active exertion or occasion- y during sleep. It is characterized by frightful pain that is utterly olerable. It is located in the region of the kidney, or along the rse of the ureter as it descends into the pelvis, but it may irra- te throughout a wider territory. Usually the cremaster muscle is smodically contracted and the testicle is drawn up to the inguinal g. The pain recurs in paroxysms which last for several minutes, d then give place to more or less complete relief. Usually the roxysm terminates abruptly, either in consequence of the return of e stone into the pelvis or by reason of its entrance into the bladder. ch attacks of colic are frequently accompanied by chills, fever, miting, fainting, loss of consciousness, and sometimes by convulsions. e patient bends himself double or throws himself into all manner of ange positions in the vain hope of mitigating his sufferings. He is rmented by a constant desire to void urine, even though the blad- r be completely empty. Hæmaturia frequently accompanies the ack. Sometimes there is complete suppression of urine when both eters are obstructed, or when only one kidney is serviceable. This asions great danger of uræmia and death, though recovery some- es occurs after the existence of supression for many days. The urn of secretion is often followed by an unusually copious discharge

contains a considerable quantity of sediment, especiall
large quantities of pure water. Occasionally the uret
obstructed for a time by a mass of sand.

The *origin of renal calculi* has been a subject of m
In many cases there is an evident connection between
mation and the precipitation of calculous matter. *Tw*
culi may be recognized, to the *first of which* belong
which are deposited in acid urine, *e. g.*, uric acid,
oxalate of calcium, and cystin (primary calculi); to
belong those concretions which are only precipitated
undergone alkaline decomposition, *e. g.*, urate of ammo
of calcium, and ammonio-magnesian phosphates (secon

DIAGNOSIS. Renal colic, by which the existence
generally indicated, may be distinguished from *lumbag*
tralgia by the accompanying changes in the urine;
tuberculosis of the spinal column, by the location of
side, or along the course of the ureter, instead of be
spinal column; from *biliary colic*, by the absence of
the location of the pain; from *embolism of the renal a*
sence of heart disease; and from *para-nephritic absces*
of swelling, and by other evidences of infiltration in t
kidney. The nature of the obstructive calculus must
the character of the urinary sediment and the reaction

PROGNOSIS. Though renal calculi are seldom atte
diate danger, the prognosis must be very cautiously
regard to the future.

TREATMENT. The course of treatment must ha
prophylaxis, and to the relief of paroxysms of colic.
patient must be regulated so as to avoid all excesses
animal food, wine and beer; the food should not,
largely of a vegetable character, since the vegetable

ually good results. The fluid extract of hydrangea, in drachm every four hours, is sometimes followed by the expulsion of us calculi which have annoyed the patient for months or years. *cid* concretions are benefited by the use of alkalies and alkaline l waters. The different compounds of lithium enjoy a high repu- n connection with this class of renal calculi; but it must not be en that lithium salts are not long tolerated by the stomach. spring water, Vichy water, and other alkaline or alkaline-saline waters may be drank with great advantage during the period of two months, or even longer, if the treatment is occasionally in- ed, in order to give the stomach rest.

uli composed of *oxalic acid* or of *cystin*, require the same general ent by diet and exercise that is useful in the management of arieties. Vegetables and fruits which contain oxalic acid must ded, *e. g.*, rhubarb, spinach, and wood sorrel. Apollinaris water, sha water, and other alkaline waters are useful.

sphatic calculi may be treated by the use of the mineral acids, rbonated waters.

paroxysms of renal colic require the use of morphine and atro- ypodermically, and chloral hydrate in doses of half a drachm or hm, warm baths, and warmth in bed. Sometimes it becomes ry to administer chloroform or ether. The bowels should be ened with calomel and jalap (10 grains of each in one powder). he calculus has entered the bladder, its final discharge may be ted by urinating while standing upon one's head.

evere and often-repeated cases of renal colic which depend upon tion of the calculus in the pelvis of the kidney, it may become ry to resort to surgical measures; of these, either *nephrolithotomy hrectomy* may be performed. The first operation is fatal in en per cent. of the cases; the second is fatal in about forty-three t.

CHAPTER IV.

DISEASES OF THE BLADDER.

CHRONIC DISEASES OF THE BLADDER.

Catarrh of the Bladder—Urocystitis Catarrhalis.

OLOGY. *Catarrh of the bladder* may be either primary or ary, acute or chronic, mucous, purulent, hemorrhagic, or gan- s.

nary inflammation of the bladder is a rare disease, and is usually by injuries, irritants, or exposure to cold. Among *injuries* to the organ is exposed may be mentioned the results of surgical

terium ureæ and micrococcus ureæ within the bladder. that inflammations which result from exposure to cold a opportunity thus given for the activity of those low which the process is aroused.

Secondary cystitis is the most common form of vesic It may be produced by stagnation of the urine, or by inflammation from other organs, or it may result from the bladder, or from general infective diseases.

Cystitis is principally a disease of middle life and of rare event among children, but old people frequentl disease as a consequence of urinary stagnation produced of the prostate gland.

PATHOLOGICAL ANATOMY. *Catarrhal inflammatic* presents different appearances, according to its acute acter, and its extension as a diffuse or a circumscrib Circumscribed cystitis usually invades the neck of th trigonum.

The mucous membrane in *acute cystitis* presents the ance of redness and swelling that characterizes mucou The muscular coat of the organ is often thickened and s times the external coats are also involved in the inflan The mucous surface is frequently abraded, and somet ulcerated. Like other hollow organs, perforation of thus produced. In certain cases the mucous memb necrosis and gangrene. Occasionally abscesses form in bladder, and may discharge their contents in either dir

In *chronic cystitis* the mucous membrane is dee blood pigment, and the veins, especially in the neigh neck of the bladder, are dilated and varicose. The m and submucous tissues are greatly thickened. The mu considerably hypertrophied, and not unfrequently the

number of such spaces, and the pouch is sometimes occupied by a stone of considerable magnitude.

SYMPTOMS. *Acute cystitis* frequently begins with chills and fever; unusual vomiting and constipation may also exist. There is an intolerable and constant inclination to void urine, even though the bladder be perfectly empty (vesical tenesmus). Evacuation of the bowels is attended with great pain. The region of the bladder is exceedingly sensitive to pressure, and painful sensations irradiate into all the neighboring organs and territories. When the neck of the bladder is principally involved, pain is especially severe in the perineum. Pressure through the rectum or vagina, and the introduction of the catheter or sound, is attended with great agony. The *urine* is scanty, high colored, and darkly colored. It frequently contains an abundance of mucus, and microscopical examination discovers numerous round cells, occasional red corpuscles, and vesical epithelium. Not unfrequently a considerable quantity of blood or pus is present, and the urine decomposes readily on exposure to the air.

In many cases the urine has undergone alkaline fermentation in the bladder, and emits an alkaline odor when it is voided. Under such circumstances it colors red litmus paper blue, but the dependence of this reaction upon the presence of a volatile alkali is proved by the speedy return of a red color to the paper after it has been dried. The sediment contains large crystals of ammonio-magnesian phosphate, and urate of ammonia; of these, the first exhibits its characteristic polygonal forms, while the second presents itself under the form of more or less regular spheroids, armed with prickles and thorny processes. (Fig. 145.) Phosphate and carbonate of calcium are frequently present in the form of minute granules or dumb-bell-like mass.

FIG. 145.



Ammonio-magnesian (or "triple") phosphates. Selected to show various forms. (FINLAYSON.)

When alkaline urine contains pus the sediment exhibits a peculiar ropy and tenacious quality, by reason of the swelling of the pus corpuscles that is produced by the action of carbonate of ammonia.

The formation of an *abscess in the vesical wall* is accompanied by chills and fever; its evacuation is followed by a copious discharge of

pus with the urine, or through the rectum. Rupture into the peritoneal cavity occasions the symptoms of peritonitis; and perforation of the vaginal wall originates a vesico-vaginal fistula. *Gangrene of the bladder* is indicated by the presence of gangrenous and offensive masses in the urine, and the occurrence of general prostration, which is followed by death.

An acute catarrhal inflammation of the bladder may run its course in a few hours, or it may continue for many weeks. Recovery is the usual result, but sometimes the disease subsides into the chronic form.

Chronic inflammation of the bladder may be the result of previous acute inflammation, or it develops gradually in a chronic form, as may be observed when a vesical calculus is its cause. The prominent symptoms are afforded by difficulty in the discharge of urine, and by changes in the quality of the secretion itself.

Vesical pain and tenesmus are less severe than in the acute form of the disease. Urine is voided with considerable difficulty, or it may continually dribble from the urethra, to the great annoyance of the patient. Sometimes the bladder becomes greatly distended with urine. Alkaline fermentation of the urine is a very common event. When the bladder has undergone concentric hypertrophy the patient is compelled to void small quantities of urine at frequent intervals, and the thickened wall of the organ can be felt through the rectum or the vagina.

The disease may persist for many years, and is liable to acute exacerbations. It may be attended by the formation of vesical calculi, or by the extension of the inflammatory process to the ureters and kidneys. Life may be terminated by uræmia or ammoniæmia.

Diagnosis. *Catarrhal inflammation of the bladder*, whether acute or chronic, may be readily recognized by the difficulties that attend micturition, by the modified character of the urine, and by the increased sensitiveness of the vesical region. Alkalinity of the urine must be ascribed to alkaline fermentation, when the presence of ammonia is demonstrated by the fugitive change of color that is exhibited when red litmus paper is turned blue by immersion in the urine. The presence of fixed alkali derived from the vegetable salts in the food, is indicated by the permanent change of color that is exhibited by red litmus paper after immersion in urine which has been thus rendered alkaline. Ammoniacal urine also contains a great quantity of microörganisms.

Prognosis and Treatment. The *prognosis* depends upon the causes of cystitis. It is comparatively favorable in acute forms of the disease. In the *management of vesical inflammation* prophylactic measures are of the utmost importance. Food and drink must be of a light and unirritating character. Milk and lime-water are especially valuable. All irritating drugs, spices, and excitants, should be prohibited; and every surgical instrument that is to be used in connection with the diseased organ must be first subjected to thorough disinfection in a five per cent. solution of carbolic acid. Local diseases, strictures, vesical calculi, and other causes of inflammation must be removed, if possible. Acute cystitis may be treated for the most part with internal remedies, but chronic cystitis also requires local treatment.

cute inflammation of the bladder requires repose in bed, the appli-
n of a warm poultice over the lower portion of the abdomen, and
bundance of warm tea (herb teas, infusion of uva ursi, or of buchu)
lute the urine. The bowels must be kept open by the occasional
of calomel and jalap. Every morning and evening the patient
ld lie for half an hour in a warm bath, which must be maintained
uniform temperature. If great pain is experienced in the perineum,
ay be relieved by the application of four or five leeches; some-
s suppositories of opium are sufficient for this purpose. Belladonna
ld not be thus used, since it sometimes increases vesical pain. Ex-
ve mucous discharges may be diminished by the use of tannic
, uva ursi, pareira brava, or small doses of balsamic remedies. The
line mineral waters are of service when no great amount of irrita-
exists. If the urine has undergone alkaline fermentation, it was
erly the custom to administer mineral acids and benzoic acid;
ntly, salicylic acid, chlorate of potassium, resorcin, and similar
edies have been advised. Especially useful is salol in doses of ten
ns every three hours. Naphthalin should be avoided, since it some-
s produces catarrhal symptoms in the urinary passages. *Chronic
itis* requires the same dietetic management as the acute disease.
bladder should be emptied every morning and evening with a soft
eter, after which it should be thoroughly irrigated with tepid water, and
injected with a four per cent. solution of nitrate of silver, which may
radually increased in strength. Many other astringents and disinfect-
have been similarly recommended, as may be learned from the text-
ks of surgery. Solutions of carbolic acid or of corrosive sublimate
t not be used—they are too poisonous. The occurrence of alkaline
entation in the bladder is the special indication for the use of dis-
ctant injections (boracic acid, permanganate of potassium, etc.), and
cially for the internal administration of salol.
f, in spite of these methods, no relief can be procured, it may be-
e necessary to open the bladder by an incision like that which is
le in the operation for the removal of a vesical calculus.
Eccentric hypertrophy of the bladder should be treated by frequent
eterization, electricity, and cold sponging, in order to invigorate
contractility of the organ. In cases of *concentric hypertrophy*,
patient should be instructed to retain the urine for at least two hours
time, in order to dilate the cavity of the organ as much as possible.

Cancer of the Bladder—Carcinoma Vesicæ Urinariæ.

TIOLOGY. *Cancer of the bladder* occurs more commonly among
en than among men, during middle life. It is generally a secondary
elopment of the disease, and is usually propagated from the neighbor-
organs to the bladder.
ATHOLOGICAL ANATOMY. *Vesical cancer* presents all the varieties
arcinoma, but usually occurs in the form of an epithelial growth
ch may be diffused throughout the mucous membrane and submu-
connective tissue, or may exist in the form of circumscribed tu-
s upon the inner surface of the bladder. The mucous membrane

is involved in a condition of catarrhal inflammation; and vesical calculi are sometimes present. As a result of ulceration, the walls of the bladder are frequently perforated, and the neighboring cavities are invaded.

SYMPTOMS. *Cancer of the bladder* can be generally recognized by investigation through the rectum or vagina, or by the discovery of cancerous debris in the urine. Sometimes the surface of the tumor is incrusted with mineral precipitates which yield a grating sensation when explored with a metallic sound, or touched with a catheter. *Villous cancers* frequently throw off portions of their substance which appear in the urine and may be submitted to microscopical examination.

When a cancerous tumor cannot be discovered in the bladder, or in the absence of cancerous masses from the urine, one of the most reliable symptoms of the disease consists in the occurrence of *hæmaturia*, especially when that symptom is associated with cachectic conditions at an advanced period of life. The occurrence of enlarged glands in the groins is also an important symptom. Hæmaturia occurs as a consequence of stone in the bladder, it is true, but it is then usually observed after active exercise on the part of the patient, while cancerous hæmaturia commonly occurs during a period of perfect quiet.

Pain is often experienced. It is usually most severe in the perineum, but it irradiates into all the neighboring regions, and differs from the pain that accompanies vesical calculus by the fact that it is not aggravated by movements of the body. In many cases, vesical tenesmus is experienced as a consequence of the associated catarrhal inflammation. Sometimes there is retention of the urine, or dribbling of urine, when the urethral opening is temporarily or partially obstructed by the cancerous tumor.

Cancer of the bladder generally runs its course within a few months, but it sometimes continues for three or four years.

The disease is fatal, and death sometimes results from hæmaturia or from uræmia, or from dropsy and exhaustion, unless the peritoneum has been penetrated, when fatal peritonitis is excited. The extension of the disease to neighboring organs is attended with most distressing consequences.

DIAGNOSIS AND PROGNOSIS. The only difficulties that attend the *diagnosis* are associated with the differential diagnosis between cancer and vesical calculus, or chronic cystitis. The *prognosis* is always unfavorable.

TREATMENT. The treatment must be symptomatic, and directed to the relief of pain and hemorrhage. Sometimes surgical measures for the removal of a cancerous tumor have been undertaken. For information regarding other tumors which may occupy the bladder, the student is referred to text-books on surgery.

In the bladder are sometimes found foreign bodies which may have been introduced accidentally, or intentionally, from without, or may have found their way from the intestines or other passages through fistulous openings into the bladder. In this way gall-stones, seeds, hairs, and intestinal flatus have sometimes entered the bladder, and have been voided with the urine.

FUNCTIONAL DISEASES OF THE BLADDER.

Enuresis Nocturna.

SYMPTOMS. *Wetting of the bed at night* is almost exclusively a sease of childhood. It usually ceases about the twelfth year of age. rine is unconsciously voided by such children during deep sleep in the st two hours after retiring, or, occasionally, just before awaking in e morning. The accident occurs during periods that are associated ith frequent remissions and exacerbations which are experienced more equently during the winter than during the summer. Children who ffer from this misfortune are generally sad and debilitated, and are sily excited by emotion, or by unusual exertion of any kind. Under ch circumstances an involuntary discharge of urine is not uncommon.

ETIOLOGY. In many cases wetting of the bed is the result of defective aining in early childhood. Sometimes it is due to errors of diet and digestion, consequent upon late suppers and the excessive consumption liquids. Warm beds and heavy blankets favor the accident.

In certain cases an *irritable condition of the urinary passages* occa- ons enuresis. It is frequently observed in cases of phimosis, or when ttle polypoid excrescences appear about the orifice of the female urethra. ometimes it is excited by the existence of pyelitis or vesical calculus. a other cases thread-worms irritate the rectum and neck of the bladder, nd thus originate the difficulty.

But, in many cases, the disorder is a *symptom of serious constitu- onal disturbances.* In certain instances it is probable that it represents masked form of nocturnal epilepsy ; and sometimes in adult patients ie disorder is a forerunner of dangerous diseases of the brain or spinal ord.

TREATMENT. Children who are so unfortunate as to be troubled ith nocturnal enuresis must be taught to empty the bladder at certain finite hours of the day and night, and they should be awakened and ken out of bed for that purpose during the early portion of the night. heir supper should consist of light easily digested food, with the allest possible quantity of liquid. The bed should be furnished with hair-mattress and thin bedclothes, and the patient should be taught lie upon one side instead of upon the back, since that position favors e involuntary discharge of urine. If the child be troubled with worms, rmifuge remedies should be prescribed. Pale and debilitated patients ould take half a teaspoonful of the syrup of iodide of iron three times day. Cold baths, the use of the flesh-brush, and country air, or the a-shore, should be prescribed. If there be any suspicion of epilepsy, omide of potassium should be given in ten-grain doses three or four nes a day. Narcotics, such as atropine, belladonna, and chloral hy- ate are frequently used. Nux vomica is recommended when urine ibbles frequently during the daytime. Cantharides blisters over the crum, and the internal use of the tincture of cantharides are frequently service. The application of faradic electricity is also exceedingly neficial. One electrode should be placed in the rectum and the other

upon the perineum or upon the hip, and the current should be passed for five or ten minutes every day or two. Galvanization of the spine is also useful.

Hyperæsthesia and Spasm of the Bladder—Hyperæsthesia et Spasmus Vesicæ Urinariæ.

SYMPTOMS. *Vesical hyperæsthesia* is indicated by the existence of an impulse to the passage of urine whenever any small quantity of the fluid has accumulated in the bladder. It is frequently associated with other nervous symptoms, such as headache, pain in the back, etc. The urine is generally pale and watery, or it may be excessively acid. Vesical spasm may affect either the *detrusor muscle*, or the *sphincter muscle* of the bladder. In the *first instance* there is a constant desire to void urine of a pale and watery character and low specific gravity, such as occurs frequently in connection with hysterical paroxysms. In the *second instance* the act of micturition is attended with difficulty, and is frequently interrupted by spasmodic contractions of the sphincter muscle that are often attended with great pain, irradiating into the perineum and neighboring regions. Sometimes both muscles are affected at the same time, producing an agonizing desire to urinate, though no successful result attends the effort.

ETIOLOGY. *Hyperæsthesia and spasm of the bladder* are encountered among delicate and nervous people who have lived imprudently, or have indulged in excessive bodily or mental exercises. Sometimes serious disorders of the brain or spinal cord exist as underlying causes of these symptoms. In other instances they are excited through the intervention of reflex irritation that has its origin in other organs.

TREATMENT. Such local causes as admit of removal should be discovered and relieved, if possible. For this purpose the alimentary canal and the pelvic organs should be carefully examined, and laxatives, or anthelmintics, should be prescribed. Pale and debilitated persons should take iron and tonics. For the relief of a paroxysm of painful spasm, the patient should be placed in a warm bath, and warm fomentations should be applied to the perineum and to the lower portion of the abdomen. Hypodermic injections of morphine, without atropine or belladonna, may be employed, or chloral hydrate may be administered. The use of electricity affords considerable benefit in severe and obstinate cases; the negative pole should be placed over the symphysis pubis, with the positive pole upon the sacrum or perineum.

Paralysis of the Bladder—Cystoplegia.

ETIOLOGY. *Paralysis* may affect either the *detrusor muscle*, or the *sphincter*, or *both muscles of the bladder*. The disorder is frequently a symptom of diseases involving the brain and spinal cord. It sometimes occurs in connection with hysteria, and it may be observed in severe cases of infective disease. Sometimes it is a result of marasmus, or physical exhaustion, or venereal excess. It may occur as a temporary consequence of opium poisoning, and it is sometimes observed as

ne result of long-continued retention of the urine. Injuries, severe hock, and violent inflammation of the bladder itself, may occasion a paretic or paralytic condition of the organ.

SYMPTOMS. *Paralysis of the detrusor muscle* of the bladder is ndicated by great distention of the organ, which sometimes rises as nigh as the ensiform cartilage, and has been mistaken for an abdominal tumor, or for the pregnant uterus. In such paralytic conditions the urine can only be voided by the aid of voluntary contraction on the part of the abdominal muscles, or by pressure with the hand over the bladder.

Paralysis of the sphincter muscle of the bladder is indicated by a continual dribbling of urine. When *both muscles are paralyzed*, a combination of symptoms exists in which the urine dribbles from an overdistended bladder.

DIAGNOSIS AND PROGNOSIS. Paralysis of the bladder may be distinguished from *inflammatory* and *spasmodic conditions* of the organ by he absence of pain, and by the non-existence of any obstruction in he urinary passages. The prognosis depends upon the cause of the isease; it is especially serious when associated with chronic catarrhal nflammation, and decomposition of the urine, which may lead to uræmia or ammoniæmia.

TREATMENT. Paralysis of the detrusor muscle creates the necessity or frequent use of the catheter in order to prevent stagnation and ecomposition of the urine in the bladder. If the sphincter muscle be aralyzed, it becomes necessary to wear a rubber urinal into which the rine may find its way.

In order to promote the restoration of contractility in the paralyzed nuscle, it is important to employ cold douches over the region of the ladder, with friction upon the abdomen and sacrum, and the application of electricity. The positive pole should be applied to the loins, nd the negative pole to the symphysis pubis when the detrusor muscle paralyzed, or upon the perineum when the sphincter muscle is nfeebled. Faradic electricity is also useful. By the use of slender lectrodes, one pole may be carried through the urethra into the bladder. Hypodermic injections of strychnine should also be employed nce or twice daily.

The general causes upon which vesical paralysis depends also require ppropriate treatment.

CHAPTER V.

DISEASES OF THE MALE ORGANS OF GENERATION.

Impotence—Impotentia Virilis.

EXCLUDING from view those cases in which impotence is the result of ngenital defects, the disease consists in the impossibility of copulaon. This may result from diseases of the testicle which have de-

stroyed its function, and have thus abolished that power of erection upon which successful copulation depends. A similar failure sometimes follows chronic diseases of the digestive organs and other causes of malassimilation and imperfect nutrition. It may be temporarily occasioned by certain poisons, like cannabis indica, potassium bromide, camphor, lupulin, salicylic acid, opium, and coffee. The excessive use of tobacco not unfrequently leads to an early loss of sexual power. It is often dependent upon masturbation, premature or inordinate debauchery, and neurasthenia.

Closely allied with this last condition are cases of impotence that have their origin in psychical causes. Violent emotions of a depressing character are frequently followed by temporary loss of sexual appetite and efficiency. The anxiety that attends inexperience during the first attempt at copulation often causes total collapse and failure under such circumstances. But this need not be any reason for discouragement, for after the novelty of intimacy under peculiar conditions has been dissipated by longer acquaintance, abnormal excitement and consequent inhibition of the copulative process are no more experienced. Leaving out of mind the danger of infection with gonorrhœa and syphilis, very imprudent is the method of procuring skill by experiment *in corpore vili*, for knowledge that is acquired in the slums often fails utterly in the presence of a virtuous and adorable bride. Patience, moderation, and time are sufficient remedies in all such cases. The applicant for medical advice usually needs nothing but encouragement. Especially should he be cautioned against the popular delusion that complete intromission must be effected at the first attempt, even at the risk of painful laceration of the vulva, in order to avoid subsequent dangers to husband and wife. Anæmic, neurasthenic, and exhausted patients should, of course, be treated on general principles. Diet, change of air and occupation, cold sponge-baths, massage, and electricity are the most useful agents.

Aspermatism.

It sometimes happens that although the act of copulation be attended with no difficulty, it is either not accompanied by seminal ejaculation, or the discharge takes place only after the subsidence of rigidity in the male organ, so that impregnation does not follow. This condition may have its origin in a *gonorrhœal inflammation* by which the ducts are constricted, and their compression is increased during the period of erection. Sometimes the difficulty consists in a long and tight prepuce (*phimosis*), and is promptly relieved by circumcision. In other cases the *prostate gland* is either enlarged so as to occlude the ejaculatory ducts, or it may be atrophied and deformed in such a way that the seminal fluid is thrown backward into the bladder. Occasionally, the *seminal vesicles* are diseased or are so obstructed that their contents cannot escape. These various conditions may result from local injury; but in certain cases the difficulties are of a psychical nature. This is usually the fact when the patient is of a nervous and debilitated constitution. It is not uncommonly observed among such persons when

ey have previously exhausted themselves by masturbation or venereal cesses.

When the disease is not dependent upon irremediable conditions of ngenital or acquired origin, it may be overcome by the removal of s causes, and by general hygienic and constitutional treatment, inclung cold baths, massage, outdoor life, restoratives, and tonics.

Azoöspermia.

Azoöspermia signifies the absence of spermatozoa from the seminal uid. This may be caused by injuries or diseases that have destroyed ne functions of the testicles, or it may be due to conditions that preent the passage of semen from the glands to the seminal vesicles. In ch cases the ejaculated fluid may possess the physical appearance and dor of semen, but it contains no spermatozoa.

The disease can only be cured by the removal of its cause; and when hat is impossible, no relief can be obtained.

Spermatorrhœa.

Symptoms. The well-known occurrence of nocturnal emissions cannot be regarded as a disease unless they recur so often as to produce atigue and depression. During periods of continence they constitute he normal method of evacuating the seminal organs, and the process y which this is effected during sleep is as physiological as the analogous process of menstruation. Unlike that function, however, there is no uniform recurrence of the incident. It is subject to wide differences, o that everyone becomes a law to himself. Perhaps once in five or ix nights may be regarded as the healthy average for young and vigorous men during the period of greatest sexual power. But if the emissions follow one another every night, or several times during a ight, and especially if they occur as an involuntary accident during he waking hours, they must be considered as evidence of ill-health. In he worst forms of the disease the flow of semen occurs without previous xcitement or erection, and is wholly devoid of pleasurable sensations. The spermatozoa are imperfectly developed, and are mixed with an exessive quantity of mucous liquid. Sometimes the urine, also, becomes harged with the substance. The trickling that sometimes follows defeation, in consequence of pressure of the feces upon the seminal vesicles, s a comparatively trifling matter, since it merely indicates a relaxed ondition of the ducts.

Many cases of spermatorrhœa occur among neurasthenic and ypochondriacal patients. To such it is usually a source of great nental anxiety, and they refer the majority of their symptoms to that ause.

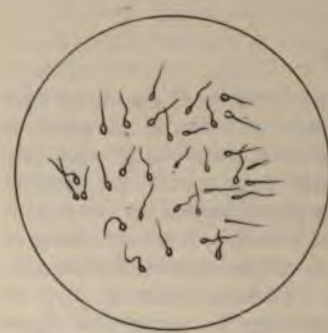
Etiology. Chief among the causes of spermatorrhœa must be laced the practice of *masturbation*. By this unnatural form of excitenent, a condition of irritable weakness is established, so that slight auses produce an inordinate reflexive response. *Venereal excesses* lso occasion a similar state of things. Sometimes the condition is due

to *phimosis*, and to other causes of irritation about the glans penis, or in the course of the urinary passages. But in certain cases the cause is located in the *brain* or in the *spinal cord*. The early irritative stage of cerebral or spinal disease is often accompanied by an increase of sexual excitement. Witness the exaggerated appetite and frequent erection that sometimes may be observed during the initial period of tabes dorsalis and of progressive paresis. *Injuries* of the dorsal portion of the spinal cord are sometimes followed by a similar result.

Spermatorrhœa sometimes occurs as a consequence of the irritability that is developed during the course of *long and wasting diseases*, like pulmonary tuberculosis, diabetes, etc., especially if the patient be of a neurotic and excitable character. Children who wet their beds at night are frequently victims of spermatorrhœa in later life.

DIAGNOSIS The nature of the discharge can be readily determined by the aid of the microscope, but whether it be a physiological occurrence or a case of pathological spermatorrhœa must be decided by reference to the history and condition of the patient. (Fig. 146.)

FIG. 146.



Spermatozoa. (ROBERTS.)

TREATMENT. The treatment of the disease must have reference to its cause. General hygienic care, good diet, a hard bed, and the habit of lying upon the side rather than upon the back, must be secured. Cold baths, the use of the flesh-brush, and an outdoor life are desirable. The alimentary canal must be kept in a healthy condition, and stimulating laxatives, excluding aloes, are often needed. Iron, compound tincture of gentian, and other restoratives and tonics may be prescribed for pale and feeble patients. Strychnine must be used cautiously by reason of its power to excite and to overstimulate the sexual apparatus. Camphor, lupulin, and similar drugs have been recommended for the relief of irritability, but their utility is very limited. When the urethra is inordinately tender, benefit sometimes accrues from the daily introduction of a cold steel sound. Massage and electricity are often of great service. Marriage should not be advised unless the health be sufficient to warrant the practice of copulation, and then great moderation should be recommended.

Prostatorrhœa.

Prostatorrhœa signifies an involuntary discharge of the prostatic secretions into the urethra. The disease occurs as a result of the enlargement of the prostate gland in old age, or as a result of the extension of catarrhal inflammation into its ducts. The discharge frequently occurs during the act of defecation, or coughing, or straining, by which the prostate gland is subjected to pressure. The liquid

sists of a milky, mucous fluid, like thin starch, and it emits a inal odor. It contains cylindrical epithelial cells, round cells, ɾloid bodies, and various pigmentary or granular masses. On the ition of a one per cent. solution of phosphate of ammonia, crystals ʊsettes that resemble the so-called asthma crystals, are precipitated, ɛther with the characteristic forms of ammonio-magnesian phosphate. 'he treatment of prostatorrhœa consists in the removal of local .rrhal disorder, and in the employment of such general measures .re useful in spermatorrhœa.



PART X.

ISEASES OF THE NERVOUS SYSTEM.

CHAPTER I.

DISEASES OF THE PERIPHERAL NERVES.[1]

SEASES OF THE MOTOR NERVES. PARALYSIS OF THE MOTOR NERVES.

Facial Paralysis—Paralysis Nervi Facialis.

IOLOGY. *Peripheral facial paralysis* consists in a paralysis of eripheral branches of the facial nerve, produced by any cause that tes externally to the origin of the nerve trunk in the facial us under the floor of the fourth ventricle. Peripheral paralysis *intra-cranial origin* when it is dependent upon disease or injury e nerve between its origin and the Fallopian canal; and it is *-cranial* when dependent upon injury or disease of the portion that utside of that passage.

ief among the causes of peripheral paralysis is *exposure to cold* on part of individuals who are liable to rheumatic disorders. In cases paralysis is dependent upon *injuries* which may be occa- l by falls, blows, bruises, compression of the nerve with forceps g delivery, operations upon the parotid gland, hemorrhages into allopian canal, etc. Sometimes inflammatory diseases, abscesses, asms, and tubercular processes in the neighborhood of the nerve, result in its paralysis. It is a not uncommon event in the course *seases involving the ear;* accumulations of wax in the external atarrhal inflammations of the middle ear, and tubercular processes ring the petrous portion of the temporal bone, exostoses, hemor- s, aneurisms of the cerebral artery at the base of the brain, and ther process by which the nerve trunk can be subjected to com- on, may produce facial paralysis.

certain cases the disease exists as a *consequence of acute infective*

r information regarding the diseases of the second, third, fourth, sixth, and cranial nerves, the student is referred to the standard text-books on the Eye ar.

diseases. It is not uncommon in association with *syphilis*, or as a result of *lead poisoning*. The disease is observed more frequently among men than among women, because they are chiefly exposed to its exciting causes.

PATHOLOGICAL ANATOMY. The pathological alterations that are exhibited as a consequence of *facial paralysis*, resemble those which follow nerve-section in the lower animals, viz., breaking up of the medullary sheath, disappearance of the axis-cylinders, and proliferation of the nuclei in the walls of the sheath of Schwann. The paralyzed muscles undergo fatty degeneration of the muscular fibres, and an increase of the interstitial connective tissue.

In slight and transitory forms of paralysis the pathological changes are undoubtedly limited to inflammatory swelling of the connective tissue in the nerve trunk, by which is occasioned temporary compression of the nerve fibres. If such inflammatory swelling involve a portion of the nerve within the Fallopian canal, it is easy to understand how readily a slight change may be followed by complete disappearance of function.

SYMPTOMS. Since the facial nerve at its point of departure from the medulla oblongata receives secretory nerve fibres, it is evident that its paralysis must be accompanied by *disturbances* of *secretion* in the salivary glands to which it sends branches. Since at the geniculate ganglion the facial nerve receives by the way of the great superficial petrosal nerve, fibres from the trigeminal nerve which become merged in the chorda tympani nerve and are distributed to the anterior two-thirds of the tongue, it is evident that facial paralysis must occasion a certain amount of *disorder in the sense of taste*. And since the facial nerve sends motor fibres through the stapedius nerve to the stapedius muscle, it is evident that its paralysis must also affect the *sense of hearing*.

Facial paralysis frequently commences abruptly, or it may be preceded by painful sensations in the ear and in the side of the face. When it is originated by chronic diseases of the ear or of the temporal bone, the symptoms of those disorders are observed for a long time previous to the incidence of paralysis

Loss of motion in the muscles of the face is the most conspicuous symptom of facial paralysis; the affected side is rendered immovable, and the cutaneous folds are less conspicuous than usual; laughter and other facial contortions produce no effect upon the diseased side; the forehead cannot be wrinkled, and the eye cannot be closed upon the paralyzed side, by reason of paralysis of the frontal and orbicularis muscles; tears trickle down the cheek in consequence of paralysis of Horner's muscle, by which the eyelids should be kept in apposition with the eyeball, consequently the surface of the conjunctiva becomes dry and liable to inflammation and ulceration; the tip of the nose and the orifice of the mouth are drawn toward the healthy side, since the non-paralyzed muscles are no longer balanced by their natural antagonists; the nasal passage upon the paralyzed side is unnaturally dry because the tears do not find their way through the tear-ducts into the nose, the naso-labial fold is obliterated, the angle of the mouth droops

hangs partly open upon the paralyzed side, so that saliva frequently
kles from that corner of the mouth. Articulation is defective, be-
e it is no longer possible to adjust the lips for the utterance of
al sounds. The movements of the tongue and of the jaws experi-
no change, since those organs are innervated by the trigeminal
e, and paralysis of the stylohyoid muscle and of the posterior belly
he digastric muscle exercises no appreciable influence upon their
tion. The act of chewing is, however, attended with some degree
ifficulty by reason of paralysis of the buccinator muscle, a condi-
that permits the intrusion of food between the cheek and the jaw;
etimes the paralyzed cheek is severely bitten in consequence of its
apse between the teeth. The external auricular muscles are also
pable of movement; and all reflex and associated movements that
end upon the facial nerve are rendered impossible by its peripheral
lysis, though they are retained when paralysis is caused by central
ns between the nucleus of the nerve and the cerebral hemispheres.
uditory disorders which occur in connection with facial paralysis
be dependent upon the special diseases in the cavity of the ear or
he petrous portion of the temporal bone by which the paralytic af-
ion is produced. But in simple nerve paralysis without accompany-
aural disease, the auditory function is exalted by the paralytic con-
on of the stapedius muscle. Under such circumstances, the unbal-
ed activity of the tensor tympani muscle, which receives its nervous
ply from the trigeminal nerve through the medium of the otic gan-
n, causes an increase of delicacy in the function of hearing.

When the cause of paralysis involves that portion of the facial nerve
t contains fibres derived from the trigeminal nerve through the me-
m of the sphenopalatine ganglion, the sense of taste is lost in the
erior two-thirds of the corresponding border of the tongue; and
etimes a peculiar metallic taste is perceived in the mouth. This
dition of the tongue may be tested by causing the patient to pro-
le the organ while it is touched with a brush or glass rod that has
n dipped in solutions of quinine, acetic acid, salt, or sugar. When
experiment is carefully performed, the results are very instructive.
loss of tactile sensibility in the tongue may be demonstrated by
sure upon its surface with the head of a pin while the patient keeps
eyes closed.

iminution in the secretion of saliva, and dryness of the paralyzed
ion of the mouth are commonly observed.

n consequence of the paralysis of those fibres of the facial nerve
h pass through the sphenopalatine ganglion and are distributed to
muscles of the uvula and soft palate, the palatine arch upon the
lyzed side is depressed, and the uvula is drawn toward the healthy
of the fauces, though this sometimes occurs independently of paral-

Peripheral paralysis is associated with *changes in the electrical
tions of the paralyzed nerves and muscles;* in connection with
h three grades of severity may be easily distinguished. Since the
rical reactions are uniform in all similar cases of paralysis, the de-
tion which applies to the consequences of facial paralysis will be
lly applicable in other forms of the disease.

In *slight forms of paralysis* the muscles exhibit very little chan in their reaction to faradic and galvanic currents; and very little, any, difference is perceptible when either the nerves or the muscles u dergo electrical excitation. (Fig. 147). The paralyzed nerves a muscles are perhaps a little more excitable than those of the healt side; and if this proportion exists after the seventh day, recovery m be expected within two or three weeks.



FIG. 147.

Ziemssen's motor points on the face. (BRISTOWE.)

In cases of moderate severity a certain amount of degeneration occurs in the axis-cylinders and medullary sheaths of the nerve fibres, and they become less capable of transmitting impulses to the muscles. The muscles during the second week also undergo degeneration. The muscular fibres diminish in size, their striæ become less conspicuous, their nuclei increase in number, and the interstitial connective tissue

nes more abundant. As a consequence of these changes, the les are unable to contract under the influence of the instantaneous ement that is produced by the faradic current, which consists of a succession of sharply interrupted impulses. Under the influence ie comparatively slow and continuous galvanic current the muscu- bres can still react, though in a somewhat sluggish and tetanoid ner. In this condition, at the commencement of paralysis electri- xcitation of the paralyzed nerve demonstrates a slight increase of ability; but, at the end of the first week, a notable diminution of ion with both forms of electricity is evident. No further change rs before the commencement of recovery, after which a gradual rn to normal conditions is observed; but, when electrical excitation rectly applied to the muscles themselves, different consequences at appear, and develop progressively during the second and third ts. At the end of the first week there is manifestly a great and easing loss of excitability under the faradic current. At the same the reaction to the galvanic current is somewhat diminished; but, ng the course of the second week, it displays considerable increase, the paralyzed muscles exhibit slowly developed and moderate con- ions under the influence of a current that is insufficient to arouse raction in a healthy muscle. Thus a galvanic current of two ampères may suffice to excite contraction in the paralyzed le, while a current of four or five milliampères might be ssary to excite the corresponding muscle upon the healthy side. des this quantitative change in the excitability of the muscle a *itative change* in its reaction becomes apparent. When a healthy le is excited by the aid of the galvanic current of progressively asing strength, its reactions may be represented as follows:

athodal closing contraction (C C C) with weak currents.
nodal closing contraction (A C C) with stronger currents.
nodal opening contraction (A O C) with strong currents.
athodal opening contraction (C O C) with strongest currents.

ut when similar currents are applied to a paralyzed muscle that is rgoing degeneration, the reactions are reversed, and A C C may the place of C C C, and by a similar reversal C O C will take the of A O C.

nder such circumstances facial paralysis requires from four to eight n weeks for its recovery. Not unfrequently the power of voluntary on returns before the galvanic reactions resume their normal char- istics. This is supposed to depend upon the restoration of the llary sheaths of the nerve fibres, by which they are rendered etent to convey voluntary impulses to the muscles.

he severest forms of peripheral paralysis of the facial muscles are ded by a rapid disappearance of reaction to both forms of elec- y when applied to the nerves. Direct electrical excitation of the les, however, is followed by the qualitative and quantitative changes have just been described. In such cases complete recovery may r occur, or at least one or two years will be requisite for its accom- ment. Not unfrequently the paralyzed muscle becomes contrac- so that the face appears as if drawn toward the paralyzed side.

The sensibility of the skin is almost always preserved upon the paralyzed side, except in cases where the peripheral lesion affects the terminal fibres of the nerves at the points of inosculation with the terminal filaments of the sensitive trigeminal nerve. Vasomotor disturbances are rarely observed.

Double facial paralysis (Fig. 148) is an uncommon event, though it has occasionally been observed either as a consequence of double

FIG. 148.



Double facial paralysis. The patient is represented in an only partially successful attempt to close the eyelids. (RUSH MED. COLL. CLINIC.)

peripheral paralysis, or as a consequence of peripheral paralysis involving one side of the face, while the other is paralyzed by a central lesion.

DIAGNOSIS. *Peripheral facial paralysis* may be distinguished from facial paralysis that is caused by central lesions, by the fact that all the branches of the facial nerve are equally paralyzed, while in *central paralysis* the frontal branch of the nerve escapes, and the eyelids can be completely closed, except in disease of the pons Varolii which injures the trunk of the nerve. In cases of central paralysis the power of reflex and associated movement of the muscles is retained, and the electrical excitability of the nerves and muscles remains unchanged, or is sometimes increased at first. *Central paralysis* is also, in the majority of cases, associated with paralysis of the extremities upon the same side, except in cases of *crossed paralysis*. The history of the case should also assist in the differential diagnosis.

The seat of the lesion by which peripheral paralysis of the facial nerve is occasioned, may be easily determined by a consideration of its anatomical relations. When *the lesion occurs outside of the stylo-mastoid foramen*, only the facial muscles are paralyzed. When *the lesion occupies the outermost portion of the Fallopian canal below the*

igin of the chorda tympani nerve, the external muscles of the ear and e occipital muscle, which are innervated by the posterior auricular erve, are also paralyzed. When *the lesion is situated between the origin f the chorda tympani nerve and the stapedius nerve*, besides the already oted paralysis, will occur disturbances of taste and of salivary secre-on. When *the lesion is situated between the origin of the stapedius erve and the geniculate ganglion*, disturbances of hearing are pro-uced through paralysis of the stapedius muscle which now enters the evious group. When *the lesion is situated in the geniculate anglion itself*, the great superficial petrosal nerve is paralyzed, and e muscles of the soft palate, which are innervated by it through the tervention of the spheno-palatine ganglion, are also paralyzed. hen *the lesion is situated between the geniculate ganglion and the ot of the nerve*, there is paralysis of all the muscles to which the anches of the nerve are distributed, and disturbance of salivary secre-on, but the sense of taste is retained, since the passage of sensory res from the trigeminal nerve through the intra-Fallopian portion of e facial nerve and the chorda tympani is not affected.

PROGNOSIS. The duration of facial paralysis is exceedingly varia-e. When dependent upon tuberculosis involving the petrous portion the temporal bone, or after injuries of a permanent character, covery cannot be expected. Permanent paralysis finally leads to rophy of the skin and muscles of the face. Relapses are not un-mmon after recovery, when the disease is dependent upon the exist-ce of the rheumatic diathesis.

TREATMENT. When dependent upon syphilis, facial paralysis quires the use of iodide of potassium and mercury; when caused by catricial tissues or other surgical diseases, operative interference is ecessary. Rheumatic forms of paralysis require the use of warm aths, warm fomentations, salicylic acid (10 grains every hour until the ars ring), or iodide of potassium in five-grain doses three times a day. he only local application that affords much benefit is the electrical urrent; the anode may be applied from two to five minutes over the astoid process upon the paralyzed side, while the cathode rests upon ie opposite process. A weak current that produces neither pain nor izziness must be employed. When the paralyzed muscles react under ie faradic current they should be exercised by the application of a ell-moistened electrode at an indifferent point, *e. g.*, over the sternum, hile with the other pole each muscle is in turn excited. The point of ie electrode should be moved from the motor point along the whole ngth of the muscle. Strong currents must be avoided, and no treat-ent should be prolonged beyond five minutes. The galvanic current ay be employed in the same way when the muscle will no longer act under the faradic current. Muscular contracture requires simi-r electrical treatment, and massage is sometimes beneficial.

Paralysis of the Motor Portion of the Trigeminal Nerve—Paralysis Rami Tertii Nervi Trigemini.

The *motor portion of the trigeminal nerve* is distributed to the uscles of mastication, viz.: the temporal, masseter, and pterygoid

muscles, the anterior belly of the digastric muscle, the mylo-hyoid, hyoid, tensor tympani, and the tensor palati muscles. Peripheral paralysis of these muscles is a rare event, though it sometimes occurs as a consequence of intracranial diseases. The temporal and masseter muscles on the paralyzed side no longer bulge under the finger during the act of mastication, and in consequence of paralysis of the pterygoid muscles the jaw is drawn toward the paralyzed side, and cannot be voluntarily carried toward the healthy side. When paralysis involves both sides, the lower jaw drops down, and the mouth hangs open. Disorders of sensation in the region of the trigeminal distribution are frequently observed.

The treatment depends upon the cause, and consists largely in the local application of electricity.

Paralysis of the Spinal Accessory Nerve—Paralysis Nervi Accessorii.

Peripheral paralysis of the spinal accessory nerve may be produced by exposure to cold, by injuries, tumors, abscesses, cicatricial tissue in the neck, diseases of the cervical vertebræ, and occasionally by intracranial compression of the nerve.

Since a considerable portion of the nerve is united with the pneumogastric nerve, it forms a constituent portion of those branches which are distributed to the pharynx, and, through the recurrent laryngeal nerve, to the muscles of the larynx. The external portion of the accessory nerve is distributed to the sterno-cleido-mastoid and trapezius muscles.

When the *sterno-cleido-mastoid muscle* is paralyzed, the face is drawn toward the paralyzed side, and the chin is turned upward by the action of the non-paralyzed muscle. After a time the paralyzed muscle becomes atrophied from disuse, and the healthy muscle becomes contractured, so that the head remains in a fixed position. When both muscles are paralyzed, the movement of the head is attended with difficulty.

Unilateral paralysis of the *trapezius muscle* causes the shoulder-blade to droop upon the paralyzed side, and the posterior border of the scapula stands further away from the spinal column than the corresponding bone. The upper internal angle of the scapula is also drawn forward and downward by the weight of the arm, and by the contraction of the rhomboid and levator scapulæ muscles. Shrugging of the shoulder and retraction of the shoulder-blade can scarcely be accomplished, since those muscles alone take part in the act. It is also impossible to raise the arm easily above a horizontal level, since the shoulder-blade can no longer furnish an advantageous fulcrum for the movement of the brachial lever.

TREATMENT. The treatment must be conducted on general principles, including the daily use of electricity.

Paralysis of the Hypoglossal Nerve—Glossoplegia.

The *hypoglossal nerve* is distributed to the lingual muscles (hyoglossus, genioglossus, styloglossus, lingualis) to the hyoid muscles

eniohyoid, omohyoid, sternohyoid), and to the external laryngeal uscles (sternothyroid, hyothyroid). *Peripheral paralysis* of the nerve a rare event. It has been observed as a consequence of wounds and mors or scars. It is indicated by paralysis of the tongue and by disrbances of the sense of taste and of the act of deglutition. When otruded, the tongue is carried toward the paralyzed side by the nonaralyzed genioglossus muscle. The paralyzed portion of the organ pears wrinkled, and exhibits fibrillary contractions in its muscular bstance. Chronic cases undergo atrophy of the paralyzed portion. *Speech* and the *act of mastication* are affected by glossoplegia. It is fficult with the partly paralyzed tongue to convey morsels of food into ie posterior portion of the mouth and into the pharynx. The articulaon of lingual sounds, *e. g.*, l, n, s, t, k, g, r, etc., becomes difficult, if ot impossible. All these disorders are greatly aggravated in bilateral aralysis of the tongue. The treatment consists in the application of ectricity.

Paralysis of the Radial Nerve—Paralysis Nervi Radialis.

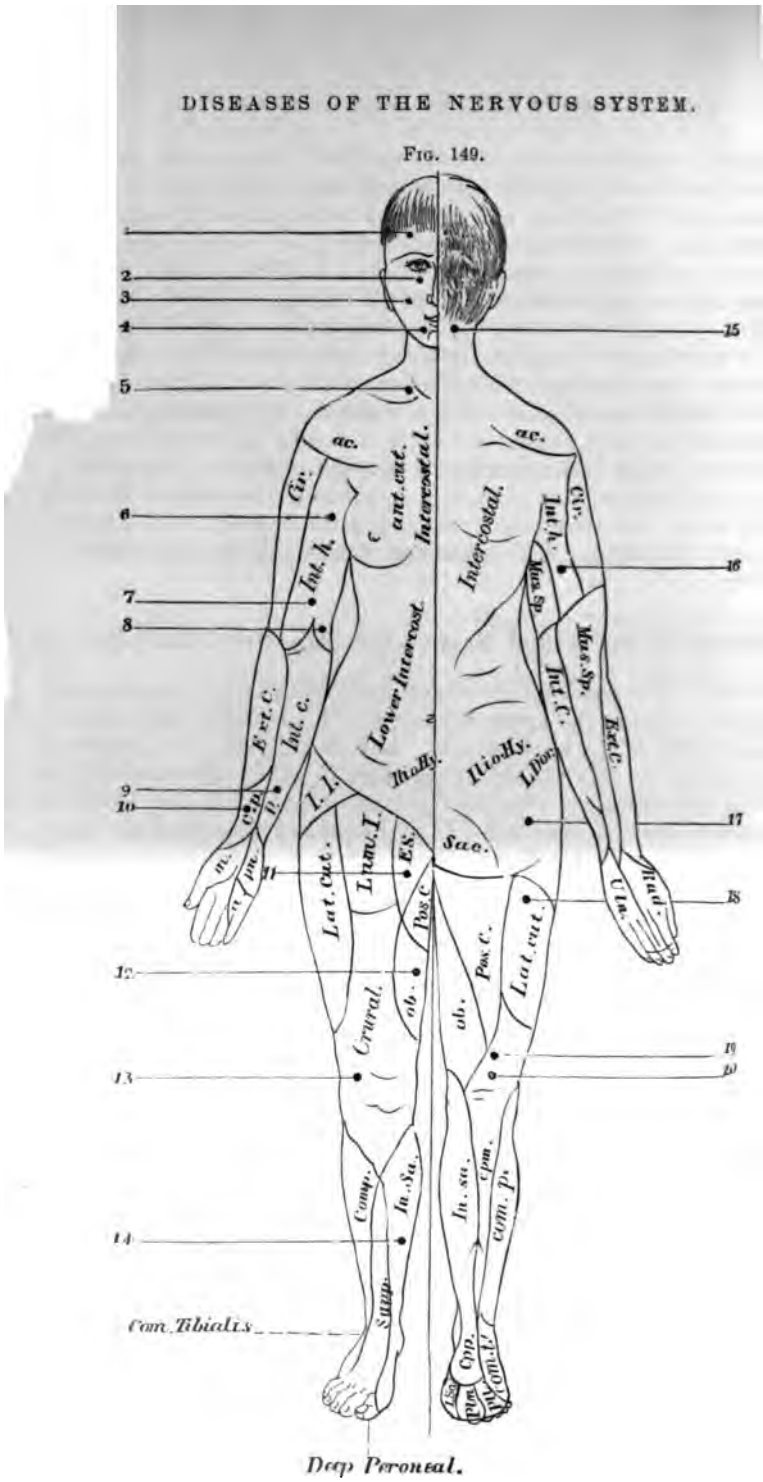
Etiology. *Paralysis of the radial nerve* is the most common form f paralysis involving the upper extremity. This is due to the long and rcuitous course of the nerve trunk. Loss of function in the nerve is sually excited by *injuries* or by *exposure to cold*. It sometimes reults from *rheumatism*, or from *lead poisoning*, and it has been observed fter various *infective diseases*. It is frequently paralyzed by *compression of the nerve trunk during sleep*. Drunken men not unfrequently hrow themselves upon a bed, and sleep for hours with the arm doubled nder the body, or subjected to pressure between the edge of the bedtead and the body; the nerve is, consequently, bruised and rendered ncapable of conducting voluntary impulses. The use of crutches, and ie pressure of heavy burdens upon the arm, not unfrequently occasion ie disease, and it has been encountered as a consequence of *hypodermic njections of ether* which have probably penetrated the nerve and proiced inflammation of its tissues.

Symptoms. *Peripheral paralysis of the radial nerve* is indicated by olition of the power of motion and sensation in the parts to which ie branches of the nerve are distributed. The cutaneous distribution in be readily learned from the accompanying diagram. (Fig. 149.) he muscles that are involved are the extensor triceps, supinator lonis, supinator brevis, extensor radialis longus et brevis, extensor digitorum mmunis, extensor digiti quinti proprius, ulnaris externus, anconæus, oductor pollicis longus, extensor pollicis longus et brevis, extensor idicis pro prius.

When the radial nerve is paralyzed, if the arm be extended horizonlly, the hand is flexed upon the wrist, and is slightly pronated; the ngers are somewhat bent, and the thumb is drawn in under the fore nd middle fingers; dorsal extension of the hand and fingers is impossble, and they cannot be used for any delicate movements like writing. he forearm cannot be supinated or extended.

Paralysis of the *common extensor muscle of the fingers* prevents

FIG. 149.



Motor points, and distribution of nerves on the superficies.

1. Seventh or facial nerve filament supplying the frontal muscle.
2. Seventh or facial nerve filament supplying the levator labii superioris alæque na

flexion of the first phalanges; and the distal phalanges cannot be led since the interosseous muscles, which are innervated by the nerve, can only operate when the proximal phalanges have been usly extended. Firm compression with the hand is, for the same , impossible, since the flexor muscles can only operate vigorously the extensor muscles can at the same time produce dorsal flexion hand.

alysis of the *radial extensor muscles* and of the *ulnar extensor* prevents adduction and abduction of the hand, if at the time the contraction of the flexor muscles of the forearm be in ay impeded.

alysis of the *extensor muscles of the thumb* and of its *long abduc-uscle* disqualifies the thumb for all movements of prehension.

alysis of the *supinator brevis muscle* renders impossible the tion of the forearm when the limb is extended.

en the forearm is placed in a position midway between pronation pination the absence of contraction may be observed in the supi- muscle when slight pressure is exerted upon the hand during the pt to bend the arm.

alysis of the *triceps extensor muscle* and of the *anconæus quartus* licated by the impossibility of extending the forearm upon the joint.

rious *subjective disturbances of sensation* are frequently expe-d in the paralyzed area, but the degree of *actual sensory paral-s* less than might be expected, since the cutaneous anastomoses are tensive that the skin retains a considerable degree of sensibility gh the intervention of the branches and terminal fibres of the aralyzed nerves of the extremity.

somotor disturbances, and nutritive changes involving the and the sheaths of the tendons, are sometimes observed. In ic cases the paralyzed muscles may undergo atrophy.

eventh or facial nerve filament supplying the zygomaticus minor.

eventh or facial nerve filament supplying the orbicularis oris and quadratus menti.

arenic nerve supplying the diaphragm.

usculo-cutaneous nerve supplying the biceps, brachialis, etc.

usculo-cutaneous nerve supplying the brachialis internus.

nar nerve supplying the muscles of forearm and hand.

adial nerve supplying the flexors of thumb and fingers.

nar nerve supplying the palmaris brevis, abductor digitor. min., opponens digitor. min., etc.

bturator nerve supplying the sartorius, adductor longus, etc.

ural nerve supplying the adductor longus, vastus internus, etc.

ural nerve supplying the vastus externus.

usculo-cutaneous nerve supplying the flexor digitorum com. long.

ccipital nerve supplying the posterior neck muscles.

reumflex nerve supplying the triceps, etc.

tercostal and nerves supplying the lumbar muscles.

luteus nerve supplying the adductor magnus, etc.

opliteal nerve supplying the gastrocnemius externus.

opliteal nerve supplying the soleus.

PROGNOSIS. The duration of radial paralysis is often very considerable, even after slight injuries. Crutch paralysis generally disappears within two weeks, but other forms of the disease frequently require six weeks or longer for a cure.

TREATMENT. The causes of paralysis must be removed so far as they are accessible. Local treatment consists chiefly in the employment of electricity. Both varieties of the current may be used with advantage. The galvanic current should be applied during the early stage of paralysis, while inflammatory conditions are presumably active. During later periods of the disease the faradic current affords the best results. Strong currents should not be used, and the applications may be made every other day for about five minutes at a time.

Paralysis of the Median Nerve—Paralysis Nervi Mediani.

ETIOLOGY. Less frequently than the radial nerve does the *median nerve* undergo paralysis. It is generally the result of injuries, and it is sometimes observed after infective diseases. It seldom results from exposure to cold.

SYMPTOMS AND DIAGNOSIS. If the lesion is situated in the lower portion of the forearm, paralytic symptoms are restricted to the muscles in the ball of the thumb (abductor pollicis brevis, flexor pollicis brevis et opponens), with the exception of the adductor pollicis muscle which is innervated by the ulnar nerve. The first and second lumbrical muscles are also paralyzed, so that the thumb is useless for all delicate manual operations. The phalanges cannot be flexed, and it cannot be placed in apposition to the fingers, though by the aid of the adductor pollicis muscle it can be placed in apposition with the forefinger, and can be drawn backward by the extensor muscles which are innervated by the radial nerve, producing an ape-like form of the hand.

When the lesion involves the upper portion of the nerve, the greater part of the muscles upon the anterior aspect of the forearm are paralyzed. The second phalanges of the fingers can no longer be flexed, because of paralysis of the flexor digitorum sublimis muscle; and the distal phalanges of the second and third fingers cannot be flexed, by reason of paralysis of the deep flexor muscle of the fingers. The remaining fingers are flexed by that portion of the deep flexor which is innervated by the ulnar nerve, which also innervates the interosseous muscles by which the proximal phalanges can still be flexed. The second and third phalanges can be extended by the same muscles. Hyper-extension of the phalanges, especially in the forefinger, sometimes exists under these circumstances. Flexion of the hand upon the wrist is very imperfect, and is attended by deviation of the hand toward the ulnar side of the wrist, in consequence of the contraction of the ulnar muscle, which is innervated by the non-paralyzed ulnar nerve. Pronation is impossible during extension of the forearm.

Trophic changes are frequently observed in connection with paralysis of the median nerve. The fingers appear smooth and glossy, and the nails are thickened and deformed; sometimes ulcerations appear in their

vicinity, and there is an increased production of hair upon the skin. Atrophy of the muscles follows their disuse.

Paralysis of the Ulnar Nerve—Paralysis Nervi Ulnaris.

Symptoms and Diagnosis. *Paralysis of the ulnar nerve* is produced by causes similar to those by which other paralyses are originated. The muscles upon the ulnar side of the hand (abductor, flexor brevis, and opponens digiti quinti) are incapable of moving the little finger, and in consequence of paralysis of the interosseous muscles and the third and fourth lumbrical muscles, it can neither be adducted nor abducted. Its first phalanx cannot be flexed, and the second and distal phalanges cannot be extended. The ulnar portion of the deep flexor muscle of the fingers is also paralyzed, so that the phalanges of the two or three external fingers are imperfectly flexed. The *adductor muscle of the thumb* is also paralyzed, so that the thumb cannot be placed in apposition with the forefinger. In consequence of *paralysis of the ulnar muscle*, flexion and adduction of the hand toward the ulnar side of the arm becomes impossible

Cutaneous sensibility is reduced upon the ulnar side of the palm of the hand, and upon the fifth and fourth fingers, and as far as the median line of the middle finger.

Atrophy from disuse follows long-continued paralysis. The ulnar side of the hand is wasted, and the interosseous spaces are deeply furrowed; sometimes the common extensor muscle of the fingers becomes contractured to such an extent that the proximal phalanges of the fingers become partially dislocated backward, while the second and third phalanges are excessively flexed by the flexor muscles of the fingers, producing a peculiar claw-shaped form of the hand. This deformity is more conspicuous in the fourth and fifth fingers, since the other fingers are still innervated by the median nerve.

Paralysis of the Musculo-Cutaneous Nerve.

Paralysis of this nerve is a very rare incident. When it occurs, the muscles by which the forearm is flexed upon the upper arm (biceps brachii, coraco-brachialis, brachialis internus) are paralyzed.

Paralysis of the Axillary Nerve—Paralysis Nervi Axillaris.

Paralysis of the axillary nerve is generally the result of traumatic causes, *e. g.*, dislocation, falls, blows upon the shoulder, crutch paralysis, etc. The symptoms have their origin in paralysis of the deltoid muscle. The upper arm can no longer be raised to the horizontal position. The deltoid muscle after a time undergoes atrophy, and the head of the humerus falls partly out of the shoulder-joint.

Associated Paralyses of the Upper Extremity.

Lesions involving the *brachial plexus* may produce associated paralyses in the different nerve trunks. The sympathetic nerve may

vertebra, a little above the clavicle and behind th
the sterno-cleido-mastoid muscle, where the fifth
emerge between the scalenus muscles.

Paralysis of the Serratus Muscle—Paralysis
Antici.

ETIOLOGY. The *serratus muscle* is innervated b
nerve, which, owing to its superficial course, is li
exposure to cold, or violent muscular exertion. D
infective diseases are not uncommon causes of its pa

SYMPTOMS AND DIAGNOSIS. *Paralysis of the*
indicated by modifications in the position of the
especially conspicuous when the arm is elevated a
While the arm hangs by the side, the inner mar
stands nearer to the spinal column than upon the he
inferior angle of the bone projects away from the th
times the margin of the scapula does not lie para
in consequence of overaction on the part of the t
and levator anguli scapulæ muscles, while by the
ralis major, biceps, and coracobrachial muscles the i
scapula is drawn outward away from the back. I
levator anguli scapulæ muscles are also paralyzed, t
conspicuous.

The attempt to raise the arm causes the poste
shoulder-blade to approach still nearer to the spin
the same time the entire internal surface and inferio
are projected backward, and stand away from the p
thorax. The arm also cannot be raised above th
since the scapula can no longer be sufficiently fixed
sary leverage for this movement The simultaneou

Paralysis of the rhomboid and levator anguli scapulæ muscles. Both of these muscles are innervated by the dorsalis scapulæ nerve. Their paralysis is indicated by the impossibility of approximating the posterior border of the scapula to the spinal column, or of raising the upper angle of the scapula.

Paralysis of the latissimus dorsi muscle. This muscle is innervated by subscapular branches of the brachial plexus. Its paralysis renders difficult to adduct the upper arm, and to draw the arm and hand behind the back.

Paralysis of the inward rotator muscles of the upper arm (subscapular and teres major muscles). These muscles are innervated by the subscapular nerves. When they are paralyzed the outward rotators of the upper arm draw the arm outward and backward, so that the palm of the hand is turned forward as the arm hangs by the side

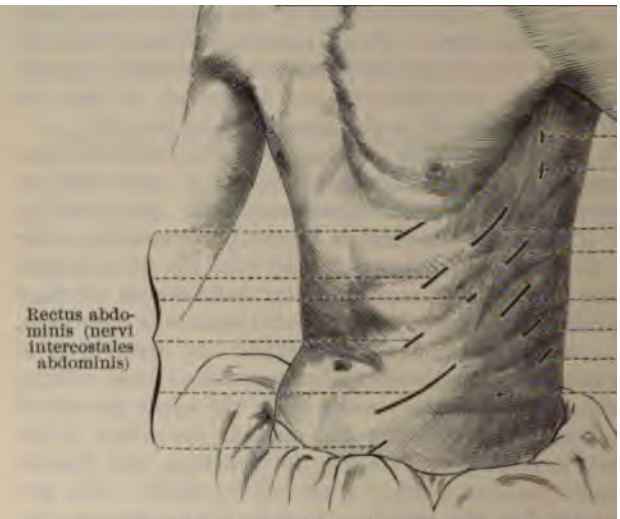
Paralysis of the outward rotators of the upper arm (infra-spinatus and teres minor muscles). The infraspinatus muscle is innervated by the suprascapular nerve, and the teres minor muscle is innervated by the axillary nerve. Their paralysis renders impossible outward rotation of the upper arm; and as the limb hangs by the side, the ulnar border of the hand is turned forward. Movement of the hand across the page in writing is very difficult when the infraspinatus muscle is paralyzed.

Paralysis of the erector spinæ muscles. When the lower portion of these muscles is paralyzed, the lumbar segment of the spinal column is projected forward as the patient stands, while the upper portion of the body is bent backward, producing the attitude described by the term *lordosis.* In the sitting posture, on the contrary, the lumbar region bends backward, producing what is termed *kyphosis.* The gait of the patient resembles that of a waddling duck, and when seated upon the floor he can only assume the erect position upon his feet by raising himself with the aid of his hands, which are placed at first upon the knees, so as to support the shoulders, and are then alternately slipped up along the thighs as he rises to the erect position—thus apparently climbing up his own limbs.

When the upper segment of the erector spinæ muscles is paralyzed, the thoracic portion of the spinal column bends one way or the other, according to the extent and location of the paralysis, producing *kyphosis* when the upper portion of the thorax is bent forward, or *scoliosis* when it is bent laterally. Paralysis of the cervical portion of the muscles renders it impossible to support the head.

Paralysis of the abdominal muscles seldom occurs. When it is unilateral, the navel is drawn during the act of respiration toward the healthy side. Bilateral paralysis renders it difficult or impossible to cough, sneeze, or perform any other movement connected with expiration or with the expulsion of the abdominal contents. (Fig. 150.)

Paralysis of the diaphragm may result from inflammatory processes within the thorax or abdominal cavity, and it may be produced by pressure of a tumor upon the phrenic nerve. It is sometimes observed after diphtheria or after lead poisoning. It is indicated by retraction of the epigastrium and hypochondria during inspiration, and by their protrusion during expiration—the reverse of normal conditions.



Thoracic and abdominal motor nerve points. (Bar

Peripheral Paralysis of the Nerves of the Low

Paralysis of the lower extremities is usually depe
or cerebral diseases. Peripheral paralysis of thei
event, and is generally produced by diseases, or tumo
that press upon the origins of the nerves near their p
from the spinal column. It may also be produced
pelvis, or by injuries, or by the neuritic inflammation
follow acute infective diseases. *The results and trea*

e crossed over the other; and when lying down, the body can- urned over from the back upon the belly. External rotation igh is also rendered difficult.

lysis of the glutæal nerves involves the glutæal muscles, the r internus, pyriform, and extensor fasciæ latæ muscles. Ro- the thigh in either direction, and its abduction are rendered It is impossible to raise the body from the sitting to the erect Walking, and ascending a flight of stairs are, therefore, very

lysis of the sciatic nerve is the most common variety of paral- he lower extremities. The disease sometimes attacks the entire d all its branches, but frequently it is limited to certain portions ervous distribution. Paralysis of the peroneal branch is the equent form. The muscles upon the posterior surface of the e not often paralyzed. When rendered incapable of function, and adduction of the thigh are hindered and the leg cannot be p against the posterior aspect of the thigh.

lysis of the peroneal nerve affects the peroneal muscles, the ex- nuscles upon the anterior aspect of the leg, and the anterior uscle. The foot assumes the varo-equinus position.

lysis of the tibial nerve causes paralysis of all the muscles in of the leg, and the flexor, adductor, abductor, interosseous, and l muscles in the sole of the foot. Plantar flexion of the foot is l impossible, and the toes can neither be adducted nor abducted. extensor muscles upon the anterior portion of the leg the foot is flexed, and the extremity rests upon the heel and inner border ot (pes valgo-calcaneus).

CHAPTER II.

SPASM OF THE MOTOR NERVES.

Spasm of the Facial Nerve.

MS involving the muscles that are innervated by the facial nerve erally of a clonic character. They may affect all of the facial or they may be limited to groups, or to single muscles.

LOGY. *Facial spasm* is more frequent in advanced life than children. It is more commonly observed among patients who o neurotic and weakly families, in which hysteria, epilepsy, and rvous disorders are common. It frequently results from chloro- exposure to cold, from injuries or diseases of the skull, or ra-cranial tumors which irritate the facial nerve.

l spasm may be excited as a reflex consequence of painful s involving the trigeminal nerve, or the nerves of the abdomi- pelvic organs; in this way it may sometimes result from the of intestinal parasites.

Facial spasm sometimes arises as a habit acquired by imitation. In many cases, however, no apparent cause for the disease can be discovered.

SYMPTOMS. Facial spasm is indicated by the occurrence of *involuntary contraction* on the part of the facial muscles, by which a very great variety of facial distortions and grimaces can be produced. Usually only one side of the countenance is affected. The visage is contorted without the knowledge of the patient, though the disorder may be aggravated by mental or physical excitement. Spasmodic movements generally cease during the night, though sometimes they occur during sleep.

Secretion and the sensation of taste are not affected. The electrical reactions of the muscles and nerves remain unchanged. In many instances *pressure points* may be discovered in connection with the disease, that is, certain points in the course of the sensory nerves are very sensitive to pressure. Compression of the tissues with the finger at these points is frequently followed by the cessation of the spasm, though occasionally it may be excited or aggravated by such pressure. These points may sometimes be discovered over the supra-orbital or infra-orbital nerves, or upon the mucous membrane of the nasal and oral cavities. Sometimes they may be found upon the transverse or spinous processes of the vertebræ, or upon the sternum, or in the intercostal spaces, or on the wrist.

Facial spasm is not attended with pain, unless it be associated with neuralgia of the trigeminal nerve. In certain severe cases, other muscles besides those in the territory of the facial nerve become involved in the paroxysms of spasm.

PROGNOSIS. The disease is never dangerous, but is usually obstinate, and sometimes continues during the whole course of life.

TREATMENT. In every case careful search should be made for causes of reflex irritation or local injury of the nerve. Carious teeth sometimes furnish the point of departure for serious disorders of this kind. Nervous, anæmic, and chlorotic patients must be invigorated by general hygienic, restorative, and tonic treatment. Large doses of the fluid extract of conium are sometimes beneficial. Rheumatic subjects require the use of salicylic acid, hot baths, and counter-irritation. When pressure points can be discovered, galvanic electricity is of great service; the anode should be placed upon the painful point, while the cathode rests upon the back of the neck, or upon the sternum or any other indifferent point. Weak currents should be used, and the time occupied by each session should not exceed five minutes. In certain cases, benefit has been derived from hypodermic injections of morphine and atropine, or of strychnine. Refrigeration with the spray of rhigolene along the branches of the nerve, has been occasionally employed with success. Surgical treatment by stretching the nerve affords only temporary relief. Nerve section merely substitutes one disease for another.

Tonic muscular spasm sometimes follows paralysis of the facial nerve, and is occasionally developed as an independent disease. It

hould be treated by the use of galvanic currents upon the paralyzed ide, and faradic currents upon the healthy side.

Spasm of the orbicular muscle of the eyelids may be either tonic (Blepharospasm), or clonic (Nictitation). Both forms of the disease are generally dependent upon diseases of the eye, by which reflex spasm is produced. It is also frequently associated with trigeminal neuralgia, and with diseases of the nasal and oral cavity, including the teeth. Pressure points can be frequently discovered, and it is astonishing to see how quickly the spasmodic closure of the eyelids is sometimes arrested when the finger is brought to bear upon some particularly sensitive spot. *Clonic spasm* of the eyelid occurs more frequently than the tonic form, and among many persons it appears more like a habit than a disease.

The treatment of these affections is the same as that which has been prescribed for facial spasm.

Spasm of the Muscles of Mastication.

Spasm of the muscles which are innervated by the motor portion of the trigeminal nerve may be either tonic or clonic. *This last variety* of the disorder most commonly occurs as a result of exposure to severe cold (chattering teeth). *Tonic spasms* are generally dependent upon traumatic causes, or tumors involving the trigeminal nerve. It may be observed in connection with trigeminal neuralgia, or with diseases involving the teeth, or after operations upon the mouth. It is sometimes observed among children as a consequence of parasites in the intestinal canal. The temporal and masseter muscles are contracted and resistant; the mouth cannot be opened; it is difficult or impossible to speak or to take nourishment. The condition may be differentiated from *ankylosis of the articulation of the lower jaw* by the firmness and tension of the contracted muscles. Under the influence of anæsthetics spasm yields, while ankylosis remains permanent. Treatment consists in the removal of exciting causes; the hypodermic injection of morphine, and the use of chloroform in severe cases. The galvanic current may be applied with progressively increasing and diminishing strength transversly through the masseter muscles.

Hypoglossal spasm. *Hypoglossal spasm* usually assumes the clonic form. It sometimes involves the tongue only in connection with movements of mastication; in other cases, it appears only during the act of articulation. It is frequently associated with spasmodic or neuralgic conditions of other nerves and muscles.

Accessory nerve spasm. *Accessory nerve spasm* involves the sterno-cleido-mastoid and trapezius muscles. It may be either tonic, clonic, unilateral, or bilateral. It is frequently excited by exposure to cold, or by injuries or diseases of the cervical vertebræ, or by infective diseases, or as a reflex consequence of teething, worms, abdominal and uterine diseases, especially when occurring among nervous and excitable

patients who belong to neurotic families. When unilateral, clonic spasm invades the sterno-cleido-mastoid muscle, the face and chin are jerked over the opposite shoulder at each recurrence of the spasm. I

FIG. 151.



Upright spinal extension frame. Posterior curved position. (STILLMAN.)

FIG. 152.



Upright spinal extension frame. Ant curved position. (STILLMAN.)

FIG. 153.



Recumbent spinal extension frame. Posterior curved position. (STILLMAN.)

FIG. 154.



Recumbent spinal extension frame. Anterior curved position. (STILLMAN.)

the trapezius muscle is simultaneously affected, the head is at the time drawn backward and outward, toward the affected shou Sometimes the spasms alternate between the two muscles. When the sterno-cleido-mastoid and trapezius muscles are simultaneousl

ed, the head is jerked now one way, and then the other, or back-
d and forward (Salaam spasm); this last form of the disease is
ost exclusively observed among children.

ike other forms of spasm, accessory nerve spasm is liable to be
ravated by mental or physical excitement; and other groups of
scles are sometimes associated in the spasmodic movement. The
ase is extremely obstinate, and may continue for a lifetime.

Tonic spasm of the sterno-cleido-mastoid and trapezius muscles oc-
ons a permanent displacement of the head, according to the pre-
inance of tension upon one side or other of the neck. The
gnosis is generally unfavorable. Treatment must consist in the
rt to discover and remove the causes of irritation, and in the use of
tricity and narcotics, as prescribed in cases of facial spasm. Great
efit is sometimes obtained from orthopædic treatment and stretching
the spinal column, according to the methods described by Stillman
other orthopædic surgeons. (Figs. 151, 152, 153, 154.) Resection
the accessory nerve and myotomy are useless.

Spasm of the muscles in the neck, shoulder, and arm. These
scles, which are innervated from the cervical and brachial plexus,
y be invaded by tonic or clonic spasms. The contractions may be
ier unilateral or bilateral, and may invade only one muscle, or many
ups of muscles. The causes and treatment are the same that have
n already described in connection with other forms of spasm.

Spasm of the splenius capitis muscle draws the head backward,
at the same time turns the face and the chin toward the affected
e. The contracted muscle may be felt under the anterior margin of
trapezius muscle, and the sterno-cleido-mastoid is relaxed upon the
ne side, though tense upon the opposite side.

Spasm of the rhomboid muscle is occasionally observed as a tonic
traction of the muscle by which the inferior angle of the shoulder-
de is drawn up toward the spinal column.

Spasm of the levator anguli scapulæ muscle causes the upper
gle of the scapula to be drawn upward, while the head is slightly
wn backward.

Spasm of the diaphragm, when it assumes the clonic form, is the
asion of hiccough or singultus. This respiratory disorder is pro-
ed by spasmodic contraction of the diaphragm, which occasions a
den and violent inspiration that is abruptly terminated by spasmodic
ure of the glottis. These successive interruptions may follow one
ther with such rapidity as to occasion dyspnœa and distress in the
gastric region. The disorder is usually observed among young chil-
n as a consequence of excessive eating or drinking, especially when
ociated with nervous excitement. It may, however, be produced by
ammatory diseases or tumors within the thoracic, abdominal, or pelvic
ities. It sometimes occurs among nervous patients who have been
austed by severe and chronic diseases or wasting discharges.

The *treatment of hiccough* requires attention to its underlying causes. Ordinary paroxysms may be relieved by drinking cold water, or by the use of aromatic stimulants. Various domestic remedies, like peppermint, paregoric, laxatives, etc., usually give relief. In severe cases it may be necessary to have recourse to hypodermic injections of morphine and atropine. Large doses of bromide of potassium are sometimes beneficial. The application of mustard to the epigastrium, and local applications of faradic or galvanic currents are of great service.

Tonic spasm of the diaphragm as a peripheral disease is usually dependent upon exposure to cold and rheumatic causes. When it occurs as a result of central nervous disease, it is a very dangerous affection, and may terminate fatally.

Spasm of the muscles in the lower extremities participates in the characteristics of other forms of muscular spasm. A special form of the disease, popularly described as *cramp in the legs*, is sometimes observed after severe muscular exertion. It not unfrequently attacks swimmers, as a consequence of violent efforts in the water. It is one of the most painful symptoms of Asiatic cholera, in which disease it is dependent upon disorders of metabolism in the tissues. It has also been observed in cases of diabetes, and in connection with disorders of the circulation, especially among pregnant women and patients who suffer with varicose veins.

Cramp may be frequently relieved by hyper-extension of the affected muscles. Not unfrequently, however, it is necessary to employ hypodermic injections of morphine and atropine, together with the external use of friction and chloroform liniment.

CHAPTER III.

DISEASES OF THE SENSORY NERVES.

NEURALGIA.

Trigeminal Neuralgia—Neuralgia Nervi Trigemini.

ETIOLOGY. *Trigeminal neuralgia* is the most common of neuralgic diseases. It is most frequently observed among women between the twentieth and fiftieth years of life, yet it is not uncommon among old people during the period of involution. Poverty, exposure to cold, and damp weather, are fruitful causes of the disease.

The *special causes of trigeminal neuralgia* are fivefold. They may be either constitutional, infective, toxic, local, or reflex.

Among the *constitutional causes* may be enumerated the influence of ɪredity; venereal excesses; extraordinary physical or mental exer-ɔn, especially when associated with care and sorrow; anæmia; ılorosis; severe and wasting discharges; frequent childbearing; ɔlonged lactation; and a predisposition to arthritic disorders.

Among *infective causes* of trigeminal neuralgia, malaria stands first. ıtermittent supra-orbital neuralgia is the usual form of the disease hen dependent upon this cause. Syphilis and rheumatism take a ıbordinate place as causes of the disease.

The *toxic form* of trigeminal neuralgia is usually dependent upon ad and mercurial poisoning.

Local causes of trigeminal neuralgia are generally the result of ex-osure to cold and damp, or to injuries which involve the territory of ıe trigeminal nerve. The eruption of wisdom teeth, and compression f the alveolar nerves by contracting tissues in the toothless jaws of old eople, are not uncommon causes of the disease. It is also sometimes ɛcited by diseases of the ears, or by inflammation of the supra-orbital aces. In certain cases it is excited by over-exertion of the ocular uscles, especially when associated with astigmatism or other defects of e eyes. In other cases the disease is dependent upon inflammatory nditions, or upon tumors which involve the trunk and principal anches of the nerve during their passage through the bony canals of e skull and facial bones.

The reflex forms of trigeminal neuralgia are usually dependent upon dominal or pelvic disorders. Sometimes they are the result of ıuries that involve other nerves of the body.

Pathological Anatomy. In many cases of trigeminal neuralgia is impossible to discover any pathological changes in the nerve; but ɪetimes inflammatory changes, proliferation of connective tissue in e sheath of the nerve, and various forms of local degeneration have en discovered, involving the nerve fibres or the ganglionic cells in e ganglion of Gasser.

Symptoms. *Trigeminal neuralgia* is almost always unilateral, and ɔst frequently invades the ophthalmic division of the nerve, producing pra-orbital neuralgia. The second division stands next in order, ıile the third division is least exposed to painful affections.

An attack of trigeminal neuralgia usually occurs in paroxysms which metimes originate suddenly, but are frequently preceded by sensations creeping or prickling in the skin. When fully developed, the pain ɜumes a terrific, boring, or burning, or lancinating character which metimes appears to be wholly superficial, but in other cases is referred the deeper portions of the face and head. The duration of the roxsyms is sometimes very brief, occupying only a few seconds, but ɣ are frequently repeated, usually at regular intervals of a few min-ɛs at the longest. Sometimes the attack begins with chills, and is ɔmpanied by perspiration, like the paroxysm of intermittent fever. equently an attack will commence without any apparent cause; in ɪer instances it is induced by slight exposure to a draught of cold air, by any physical or mental form of excitement.

Attacks occur more frequently during the day than by night. In

many cases the intervals are free from pain, and are characterized by apparently good health. In certain cases, however, the attacks are so frequent that the patient complains of almost constant suffering, and exhibits signs of considerable exhaustion.

In a large proportion of cases *pressure points* may be discovered along the course of the nerve branches, especially over the foramina through which they emerge from their bony canals, or even upon distant portions of the body, chiefly along the spinous or transverse processes of the vertebræ.

In many instances *vasomotor and secretory disturbances* are manifested in the territory occupied by the trigeminal nerve; the skin is reddened, exhibits elevation of temperature, and is covered with perspiration; the bloodvessels dilate, and the arteries pulsate; the conjunctivæ are injected, tears flow freely; the mucous membrane of the nose and of the mouth secretes inordinately.

Trophic changes are frequently observed. Aphthous ulcerations and hemorrhagic extravasations sometimes take place within the mouth. Herpes and other cutaneous eruptions may appear about the lips or along the course of the affected nerve branches. The hair frequently turns gray, sometimes recovering its natural color after the termination of an attack. Iritis, choroiditis, glaucoma, and neuro-paralytic ophthalmia have been observed. The tactile sensibility of the skin seldom manifests any considerable alteration. The sense of taste is frequently disordered, and sometimes the sense of hearing is temporarily affected during an attack.

Spasmodic contractions of the facial muscles frequently accompany the paroxysms of neuralgia. Sometimes the muscles of the extremities are also involved in the spasmodic process.

PROGNOSIS. The prognosis is dependent upon the causes of the disease, which may continue, accordingly, during a very variable period of time. The disease is frequently chronic, and is liable to relapses after apparent recovery.

TREATMENT. The treatment should include a careful search for, and removal of, the causes of the disease. When it is dependent upon malaria, it may be soon relieved by large doses of quinine or arsenic. When dependent upon exposure to cold and rheumatism, salicylic acid should be freely administered. Syphilitic cases require the use of iodide of potassium and mercurials. Constipation must always be prevented; and morbid conditions of the blood require appropriate treatment. In many instances the disease is relieved by proper care of the teeth, or by the cure of disorders in the nasal passages. In certain cases which do not appear to depend upon any discoverable cause, the attacks of pain may be arrested by the administration of drachm doses of quinine. Hypodermic injections of morphine and atropine are useful, but this method of treatment should never be intrusted to the patient, since in the majority of cases the opium habit soon becomes established. The application of electricity in the form of a galvanic current sometimes affords temporary relief. The painful region should be included between the two poles of the apparatus, the anode being placed over the seat of pain; the current should be used for five minutes, several times

a day. Veratrine ointment, cups, blisters, and chloroform liniment, sometimes give relief. For internal use, in rheumatic cases, may be recommended crystallized aconitine in doses of $\frac{1}{200}$ of a grain every two hours, until the peculiar tingling sensation produced by aconite is recognized. Tincture of colchicum and tincture of aconite may be given three times a day.

℞.—Tr. aconit. rad. ℥j.
Tr. colchici ℥ij.—M.
S.—Ten drops three times a day.

Large doses of antipyrine, acetanilide, or phenacetine, may be given three or four times a day. Iodide of potassium is sometimes useful in doses of five or ten grains three times a day. The nerve tonics are frequently useful, viz.: nitrate of silver, chloride of gold and sodium, carbonate of iron, phosphide of zinc, and nux vomica. Strychnine is sometimes beneficial when given in doses of $\frac{1}{16}$ of a grain every four hours. Chloral hydrate and butylchloral are also beneficial; and the tincture of gelsemium, in doses of five to twenty drops three times a day, is highly recommended by many.

When the disease appears obstinate and will not yield to these measures, surgical interference becomes necessary. Stretching or section of the affected nerve gives only temporary relief. Thorough exsection of the affected portion of the nerve is attended by favorable results in many cases.

Occipital Neuralgia—Neuralgia Cervico-Occipitalis.

Occipital neuralgia is excited by the same causes that produce trigeminal neuralgia. It is characterized by painful paroxysms which originate in the upper part of the post-cervical region and follow the tracks of the nerves as far as the inter-parietal line over the top of the head. Sometimes the trigeminal nerve branches are at the same time involved, and the pain may irradiate into territories that are occupied by other nerves.

Pressure points are found between the mastoid process and the first cervical vertebra where the occipital nerve approaches the surface. Another point may be found upon the parietal prominence. Others exist along the spinous process of the cervical vertebræ. The scalp is usually in a condition of hyperæsthesia, so that contact with the hair excites paroxysms of pain.

Vasomotor disturbances are exhibited on the part of the sympathetic nerve fibres, frequently producing changes in the diameter of the pupils, and dilatation of the blood vessels in the affected ear and side of the face; the conjunctivæ are injected, tears are secreted in excess, and the skin of the face feels warmer than natural. Subjective disturbances of hearing sometimes occur. Trophic changes are rarely observed. In rheumatic cases the cervical lymph glands frequently swell. In certain cases muscular spasms are developed, and severe vomiting sometimes accompanies an attack.

The *duration* of the disease is variable. In certain cases recovery

never takes place, though this is less common than in trigeminal neuralgia.

The *treatment* must be conducted in accordance with the rules laid down for the treatment of trigeminal and other forms of neuralgia.

Phrenic neuralgia. *Phrenic neuralgia* is characterized by paroxysmal pain in the lower part of the thorax and along the whole course of the phrenic nerves. It may be either unilateral or bilateral. Painful sensations frequently irradiate into the neck, shoulders, and arms. Pressure points exist along the insertion of the diaphragm, and upon the spinous processes of the cervical vertebræ, and in the lateral portion of the neck. The movements of respiration are frequently subjected to great disturbance, and the act of swallowing is attended with great difficulty. The disease is frequently difficult of recognition, since it may be easily confounded with angina pectoris, or with pleural and peritoneal diseases.

Cervico-brachial neuralgia is almost always unilateral. It may involve only a single nerve, or an extensive group of nerves. Motor disturbances are frequently associated with the sensory disorder, since the nerves of the extremities contain both motor and sensory fibres.

Pain constitutes the principal symptom. It is especially severe after gunshot wounds of the nerves. It usually occurs in paroxysms which are aggravated by movement and by the warmth of the bed at night. Partial relief is frequently obtained by carrying the arm in a sling. *Pressure points* do not appear with any degree of regularity. *Vasomotor disturbances* are very commonly observed, and consist either in pallor and coldness of the skin (vasomotor spasm), or in an increase of redness and temperature (vasomotor paralysis). Sometimes there is copious perspiration. *Trophic changes* appear in the form of herpes zoster, urticaria, eczema, pemphigus, increased growth of hair, thickening and incurvation of the nails, glossy fingers, etc. *Muscular spasms*, fibrillar contractions, and paralysis are sometimes observed. The hand sometimes assumes the form of a claw, and in many cases it becomes impossible to perform acts of precision, like writing, sewing, playing on musical instruments, etc. The duration of the disease depends upon its causes, which in certain cases are irremediable.

Intercostal neuralgia may involve any one or all of the dorsal nerves. *Pain* is usually manifested in the intercostal division of the nerves, though in certain cases the dorsal division participates in the disease. In such cases the painful territory may extend from the neck as far as the crest of the ilium and the symphysis pubis. The disease is excited by causes similar to those that have been already enumerated in connection with trigeminal neuralgia. It is frequently associated with *diseases of the respiratory organs*, and it is frequently caused by *reflex influences* that proceed from the *abdominal and pelvic organs*. It often occurs during the period of convalescence *after infective diseases*, and it is almost always associated with the eruption of *herpes zoster*. The painful symptoms of intercostal neuralgia are generally unilateral,

they are frequently accompanied by irradiations of pain into the ritory of other nerves. The left side of the body is most frequently ected, in consequence of the more circuitous course of the blood ich, on that side, finds its way into the hemiazygos vein before reach- the vena cava. Venous congestion of the nerves may, therefore, more easily produced by slight disturbances in that region than upon opposite side. Intercostal neuralgia occurs in the form of painful roxysms which may be aroused by muscular exertion of every kind. metimes the slightest movement or contact is sufficient to excite an ack. *Pressure points* may be frequently discovered in three sepa- te localities which are associated with each nerve; over the point of ergence of the dorsal branch near the spinous process of the corre- onding vertebra; over the point of emergence of the lateral branch the nerve in the axillary line; and at the terminal extremity of the rve near the border of the sternum.

In many instances the skin in the neighborhood of the affected nerve hyperæsthetic. Occasionally the opposite condition of anæsthesia is anifested. Herpes zoster is frequently developed in connection with tercostal neuralgia.

Intercostal neuralgia may be differentiated from *rheumatism of the tercostal muscles* by the fact that they are not particularly sensitive pressure, and that the pain is paroxysmal, while the opposite condi- ons of sensitiveness to pressure and persistence of pain are character- tics of rheumatism.

Pleurisy is marked by other concurrent symptoms of disease within e thorax. *Periostitis of the ribs* is accompanied by local swelling pon the costal surfaces. *Gastralgia* is indicated by concomitant dis- rders of the stomach.

Mammary neuralgia (mastodynia) is an intercostal neuralgia that vades the mammary gland. It is generally encountered in the female ex during the first fifteen years of adult life. It may be caused by ny of the ordinary antecedents of neuralgia, and it is frequently bserved as a consequence of prolonged lactation, or disturbance of enstruation. In many instances indurated masses can be felt in the bstance of the gland during the paroxysms of pain. Their exact ature is not clearly understood.

Lumbo-abdominal neuralgia has its seat in the course of the four st lumbar nerves (ilio-hypogastric, ilio-inguinal, lumbo-inguinal, and ternal spermatic.) *Painful paroxysms* are experienced in the loins, ps, lower portion of the abdomen, and groin. *Pressure points* may discovered near the spine, upon the crest of the ilium, and above the oin. Contraction of the cremaster muscle frequently occurs, and the sical and vaginal discharges are increased.

Crural neuralgia follows the course of the crural and saphenous erves, along the anterior and inner surfaces of the thigh and leg to the ner border of the foot and the great toe. *Pain* is increased by walk- g and by other movements of the leg. It is frequently aggravated at

Etiology. *Sciatic neuralgia* is a very common more frequently among men than among women, be and sixtieth years of life. It is dependent upon th neuralgia, and is especially common as a conseque wet and cold. It is frequently originated by injurie kinds that involve the lower portion of the spinal and the pelvic organs. It is sometimes associated scurvy, purpura, etc.; and it is often encountered central diseases involving the spinal cord. It ma infective diseases, including those of malarial, sy rhœal origin.

Pathological Anatomy. Sciatica of a purely presents no visible changes in the structure of the forms of the disease exhibit all the appearances wh flammation of a nerve. Compression by a neighbori by atrophy of the nerve.

Symptoms. *Sciatica* usually occurs as a unilate involve the whole territory of the nerve, or it may a limited portion of its distribution. When thus occupies the posterior cutaneous branch, or, in certa region of the foot.

The *pain* of sciatica is constant, although it may increased severity which are aggravated by movem body, and are worse at night than during the dayti

Occasionally pain is diminished by walking or b the body upon the affected limb. In many cases simultaneously involved in the neuralgia paroxy

patient is frequently compelled to bend the knee and to draw thigh, so as to relax the muscles and tissues of the limb, and e is forced to lie motionless, with the back bent forward and the lrawn up to the body, in order to prevent the incidence of agon- aroxysms of pain. It is often impossible to sit up, or to assume ct position, much less to walk about. Constipation frequently and always aggravates the disease. Sugar is often present in ne.

GNOSIS. Sciatica must be differentiated from *coxitis* and from which are characterized by a peculiar position of the limb, and n on rotation of the thigh, or pressure of the head of the femur its socket. In *muscular rheumatism* the muscles are par- ly painful on pressure. *Hysterical pains* must be differentiated ntion to the general condition and symptoms of the patient.

GNOSIS. The prognosis depends upon the nature of the causes. a is often a very chronic disease. It gradually develops, persists me, and then slowly subsides. Relapses are frequent.

ATMENT. Every case of sciatica requires treatment in accord- ith its underlying cause. Repose and warmth, together with a state of the bowels, must be secured. Great relief is often ob- by wrapping the entire limb with cotton-wool, which is then l with a sheath of oiled silk or rubber cloth. The limb should ed every morning with turpentine or chloroform liniment. Iodide ssium should be administered in five- or ten-grain doses three day. In recent cases pain is sometimes aggravated by the em- nt of electricity, but chronic cases are greatly benefited by its The galvanic current should be employed with the aid of unusu- rge electrodes. The faradic brush sometimes affords relief. benefit is afforded by the use of hot baths, at the Hot Springs of sas, or the brine baths at Mt. Clemens, in Michigan.

remedies which have already been recommended in the treat- f trigeminal neuralgia are useful in cases of sciatica. When e can be endured, daily massage is very beneficial. Obstinate nay be treated by nerve-stretching, an operation which can be ned, with at least temporary relief, by forcibly flexing the thigh the abdomen, while the leg is firmly held in the position of ex- . It is sometimes necessary to render the limb motionless by lication of a thigh splint, as if treating a fracture of the femur.

matic neuralgia involves the spermatic nerve and invades the which becomes sensitive to pressure, and is sometimes tumefied. roxysms of pain are often attended with great agony, but may inguished from *renal colic* by their location and by the healthy of the urine. The disease is usually encountered among pale rvous young people who have exhausted themselves by venereal s. It may also occur as a consequence of varicocele, or as a m of hysteria. The other causes of neuralgia may frequently overed. Similar pain may be often encountered in other neigh- nerves, invading the bladder, the perineum, and the rectum.

Coccygodynia is characterized by severe pain in the coccyx, and is increased by pressure of any kind and by movement of the body. It generally occurs among women, and is probably dependent, in the majority of cases, upon organic disease of the bone itself. It generally becomes necessary to cut the bone free from its connections with the neighboring parts, or to remove it altogether.

Neuralgia of the joints is usually observed among neuralgic women, and is dependent upon the ordinary causes of neuralgia and hysteria. It is characterized by paroxysms of pain which cannot be referred to any local changes in the affected joints. The hip and knee joints are the favorite seats of the disease, though the small joints are sometimes involved. During the occurrence of a paroxysm the painful joint exhibits redness, heat, and swelling, which immediately disappear with the cessation of pain. Slight contact with the skin is more distressing than firm pressure. Sometimes *muscular spasms* occur; and during a painful paroxysm the affected limb is held in a position of extension, instead of being flexed, as in inflammatory diseases of the joints. *Pressure points* about the joints can usually be discovered, as in other forms of neuralgia. The duration of the disease is very chronic, and the treatment is often as unsuccessful as in other cases of hysteria.

CHAPTER IV.

ANÆSTHESIA.

Anæsthesia is the result of every morbid process in the sensory organs by which the perception of sensations is diminished or abolished. It may, therefore, involve every portion of the body in which sensory nerves are distributed. *Cutaneous anæsthesia* is the most common form of the disorder, and it alone will be considered in the present chapter.

Two forms of sensation may be distinguished in the cutaneous nerves: *tactile sensation* and *common sensation*. Of these, the *first* includes four varieties:

1. Simple perception of contact with foreign bodies.
2. Sensation of pressure.
3. Sense of locality.
4. Sensation of temperature.

The *second form* of cutaneous sensibility comprises the perceptions of pain, electrical excitement, pleasure or discomfort, and such peculiar modifications of sensation as occur in tickling, itching, sexual excitement, etc.

For the recognition of sensory disorders, much time and patience is requisite. Many of the methods that are employed for this purpose afford results which are highly interesting to the physiologist, but are of

tle practical importance from a clinical standpoint. Full particulars ith regard to these methods of investigation may be found in Landois nd Stirling's *Physiology*.

The condition of *simple tactile sensibility* may be estimated by autiously touching the skin of the patient, whose eyes have been reviously bandaged, with the tips of the fingers, or with the head of a in, or with a camel's-hair brush, or with a soft feather.

The sense of pressure may be estimated by laying upon the surface f a well-supported limb, or other portion of the body, definite weights hat can be increased at regular intervals by the addition of equal pieces f money, which can be piled upon one another. In this way a comarison can be introduced between different parts of the bodily surface, nd the minimal degree of pressure that can be perceived may thus be eadily determined.

For the investigation of *the sense of locality* it is necessary to deterine the power of accurately locating the point of irritation, and also o determine the size of each tactile circle within which different imressions excite single perceptions. The first can be ascertained by askng the patient, when his eyes are bandaged, to accurately describe the oints of contact with which the experiment is concerned. The diameer of the various tactile circles within which manifold impressions of ontact are perceived as single sensations, may be readily determined y the use of the *æsthesiometer*. An instrument with blunted points s preferable, in order to avoid arousing painful sensations by the conact of sharpened points. The distance which separates the two points s readily measured upon the graduated scale of the instrument. If heir simultaneous contact with the skin is perceived as a single sensaion, as if only one point were in existence, their distance must be ncreased until their contact is perceived as a double sensation. The disance indicated by the scale is the semi-diameter of the tactile circle.

The temperature sense may be most conveniently determined by successively touching the skin with test-tubes that have been filled with vater of different temperatures.

Painful sensations may be estimated by pinching the skin, or by pricking it with a pin, or by pulling the hair. In this way the absence f painful sensation may frequently be demonstrated, though tactile ensibility be retained. This condition is termed *analgesia*. In a omewhat similar way the sensitiveness of the skin to electrical impressions may be determined.

Total anæsthesia is characterized by the absence of every variety f cutaneous sensibility. In cases of *partial anæsthesia* one or more arieties may be retained. In certain cases a transposition of perceptions occurs, so that heat is perceived as cold, and *vice versâ*. In certain cases of dorsal tabes the prick of a pin is first perceived as a simple actile impression that is, after a little time, succeeded by a sensation of ain. Painful impressions are sometimes doubled in a similar manner, nd in certain cases a single impression is perceived as a three- or fourold sensation (polyæsthesia). Such modifications of sensation are lependent upon a peculiar retardation in the conduction of impressions o the brain.

Cutaneous anæsthesia may be either diffuse or circumscribed. It is unilateral, when dependent upon diseases of the brain (hemi-anæsthesia), and in certain spinal diseases it may be limited to the inferior portion of the body and the lower extremities (paranæsthesia).

ETIOLOGY. *The causes of anæsthesia* may be located in the end-organs of the sensory nerves, or in the course of the peripheral paths between those structures and the brain, or in that portion of the brain where perception originates. Very little is known regarding the conditions in the end-organs of the nerves by which sensation is affected. The peripheral paths are principally influenced by changes in the circulation of the blood. The arrest of circulation in a limb is followed by anæsthesia in that portion. In many cases the application of cold is followed by loss of sensation, and the surgeon frequently takes advantage of this fact to produce surgical anæsthesia by the use of cooling sprays which lower the temperature of the surface. Certain chemical compounds, *e. g.*, caustic alkalies, acids, and carbolic acid, may thus destroy the sensibility of the skin, and the hypodermic use of cocaine or morphine is followed by a similar result. Many poisons have the power of destroying cutaneous sensibility, and it is a well-known fact that infective diseases are frequently followed by anæsthesia. The paralyzing influence of rheumatism, of traumatisms, inflammations, and compression, by which the nerves may be involved, requires no further mention.

In certain cases cutaneous sensation is modified in such a way that the patient complains of *abnormal sensations* (paræsthesia) such as cold, stiffness, tension, prickling, and formication. In other cases, though anæsthesia is fully developed, intense neuralgia may still be experienced (anæsthesia dolorosa). In such cases the path of sensation is interrupted at some point, so that the brain can no longer perceive sensations that are excited upon the cutaneous surface, but the disease or injury at the point of interruption is sufficient to excite in the brain perceptions which, in accordance with the well-known laws of physiology, are referred to that cutaneous surface with which the brain should communicate by means of the injured nerve.

Motor disturbances are readily associated with sensory disturbances, since the peripheral nerves so generally contain both motor and sensory fibres.

Peripheral anæsthesia may be readily differentiated from that which is dependent upon diseases in the brain and spinal cord by the loss of reflex movements which accompanies its development. When the lesion is located above the spinal origin of the nerve, the reflex arc remains intact, and reflex movements may still be excited.

Vasomotor disturbances and *trophic changes* frequently accompany the development of anæsthesia.

TREATMENT. The causes of anæsthesia must be removed if possible. The local affection of the skin may be treated with friction, massage, irritating liniments, and the application of electricity. The cathode should be applied to the anæsthetic surface, or the faradic brush may be employed with advantage.

Anæsthesia of the trigeminal nerve is not a very common disease, but it affords an excellent example of cutaneous anæsthesia. It is generally dependent upon exposure to cold, or upon injuries and diseases that involve the course of the nerve and its branches. It is usually a unilateral disease, and it is sometimes associated with paralysis of the motor portion of the nerve. Loss of sensation in the face can be readily demonstrated, and it is sometimes associated with paræsthesia or with anæsthesia dolorosa.

In certain cases the *conjunctiva and cornea* are affected, and contact with the cornea does not occasion winking or an increased secretion of tears, a circumstance which differentiates peripheral trigeminal anæsthesia from that which is dependent upon central causes. *Sneezing* and other reflex consequences of irritating the *mucous membrane of the nose and mouth* can no longer be produced. *The sense of taste* is sometimes disturbed, even though the facial nerve be uninjured, a fact which seems to indicate that the sense of taste is not entirely dependent upon fibres derived through the chorda-tympani from the facial nerve. The existence of *vasomotor and trophic disturbances* is frequently demonstrated by redness, swelling, and heat in the territory of the trigeminal nerve, by ulceration in the mouth, and by the eruption of herpes. Inflammation of the eye (ophthalmia neuro-paralytica) is sometimes witnessed. This has been supposed to depend upon trophic changes under the influence of trophic fibres proceeding from the ganglion of Gasser, but it is probable that the disease is dependent upon anæsthesia of the cornea which renders it insensible to slight injuries and favors their infection by the microörganisms that excite inflammation.

CHAPTER V.

DISEASES OF THE NERVES OF SPECIAL SENSE.

Olfactory hyperæsthesia (hyperosmia) is a condition of the olfactory nerves which renders the patient capable of perceiving odors that are imperceptible to other persons; and under the overpowering influence of ordinary smells they sometimes experience faintness, dizziness, or convulsions.

Olfactory anæsthesia (anosmia) is a condition in which the sense of smell is more or less completely abolished. Such patients may still retain the power of perceiving pungent impressions, like those of ammonia or vinegar, which depend upon the functional integrity of the trigeminal nerve. In certain cases, although the sense of smell is completely lost, there is complaint of disagreeable odorous sensations which are undoubtedly excited either by impressions that arise at the point of injury in the peripheral nerves, or in the central organs themselves. The sense of taste is frequently impaired, since much of our appreciа-

They may have their origin in diseases of the t
the glosso-pharyngeal nerve, or of the facial nerve
thirds of the tongue is innervated by the lingual
its special sensory fibres from the facial nerve thr
of the chorda tympani, while the posterior third o
fauces are innervated by the glosso-pharyngeal ne
of the chorda tympani are derived from the sph
through the intervention of the great superficial
claimed by many that they are originally deriv
pharyngeal, which anastomoses freely with the tri

The sense of taste may be resolved into the fo
sour, bitter, and salt. The susceptibility to sw
tested by causing the patient to protrude the t
touched with a piece of paper, or with a glass r
cessively dipped in the different test solutions. T
nounce his decision before withdrawing the to
should be thoroughly rinsed with water after each
may be readily ascertained that in the normal
most readily perceived at the tip of the tongue, a
while bitters are most distinctly recognized at the

Gustatory hyperæsthesia (hypergeusia) consis
the sense of taste, and is frequently encountered
hysterical persons.

Gustatory anæsthesia (ageusia) consists in a
the sense of taste. It is frequently observed in c
in which the tongue is thickly coated and the mou
It is very commonly observed in cases of trigemin
It should be treated by the application of galvanis
of remediable causes.

CHAPTER VI.

ORGANIC DISEASES OF THE PERIPHERAL NERVES.

Inflammation of the Nerves—Neuritis.

PATHOLOGICAL ANATOMY. *Neuritis* may be either *interstitial* when he connective tissue of a nerve is inflamed (perineuritis), or *parenchy-matous* when the nerve fibres themselves are involved. The disease ay be circumscribed, or it may be progressive (neuritis migrans). When the disease is propagated from the periphery toward the central ervous organs, it is termed *ascending neuritis;* when it follows the pposite course it is termed *descending neuritis;* when it progresses iscontinuously over the healthy portions of the nerve, it is termed *dis-eminated neuritis.* The favorite seats of neural inflammation are the icinity of the joints, the bony canals through which the nerve trunks ass, and other points where they lie closely in contact with bony urfaces.

Perineuritis may be either acute or chronic. In the *acute form* the erve appears swelled and succulent, in consequence of the dilatation of s bloodvessels. Microscopical examination reveals an increase of uclei and other evidences of inflammation in the vascular walls. The xtra-vascular spaces are filled with round cells and colorless blood cor-uscles that are undergoing fatty degeneration, and sometimes red blood-orpuscles are abundantly extravasated. In severe cases blood stagna-on is followed by parenchymatous degeneration also, and the changes at follow nerve section are developed in greater or less degree. The edullary sheaths of the nerve fibres degenerate and disappear, and e axis-cylinders in like manner become involved, while the nuclei in e sheath of Schwann are greatly multiplied. In severe cases sup-uration may occur, with complete destruction of the entire nerve ructure.

Chronic perineuritis may be either the result of acute inflammation, it may be gradually developed as a chronic disease. The inflamed erve becomes thickened by proliferation of the connective tissue, and acquires a darker color by the deposit of blood pigment in its sub-ance. In many cases the nerve fibres disappear altogether, and the erve becomes transformed into a simple band of connective tissue clerosis). In certain cases the nerve trunk becomes nodulated, so at it somewhat resembles a string of beads, and in this way actual *euromata* may be originated. In many instances inflammatory adhe-ons between a nerve trunk and neighboring tissues may become the urce of subsequent distress and disorder of function.

Parenchymatous neuritis rarely occurs as an independent disease. he best example of its development is exhibited in a nerve which has en subjected to a solution of continuity. The peripheral portion of

such a nerve undergoes changes that are effected by degenerative inflammation.

Etiology. *Neuritis* is produced by exposure to cold, by injuries, by many infective diseases, by poisoning with lead and other metals, or with organic substances. It occurs in the course of metabolic diseases like diabetes, gout, etc., and is associated with the development of the various forms of cachexia. It is often the result of inflammation that has been propagated from other organs.

But in many cases the causes of neuritis elude discovery. Migrating forms of inflammation sometimes pass from the periphery to the spinal cord without involving the intermediate nerves, or they may, in like manner, extend from one side of the body to the other while the central portions escape without injury. It is probable that in many such cases, as in tetanus, the dissemination of inflammation is dependent upon the circulation of toxic products of bacterial origin.

Symptoms. The course of an inflamed nerve may be frequently traced by a certain amount of superficial redness, and by evident swelling of the nerve trunk which is painful on pressure. In acute inflammation of the sensory nerves, *tactile impressions* are less readily perceived in its territory, though the perception of pain is greatly exalted (hyperalgesia). *Loss of sensation* follows serious injury of the nerve by inflammation. Various *modifications of sensation* (paræsthesia) are frequently observed during the course of inflammation. Pain is frequently aggravated at night. *Trophic changes* are not uncommon, viz., herpes, thickening and exfoliation of the epidermis, glossy fingers, changes in the nails and ulceration around their roots, swelling and stiffness of the joints, perforating ulcer of the foot, etc.

When neuritis involves a motor nerve, various forms of spasm or fibrillary contractions of the nerves may be observed. Contractions and paralytic changes are frequent occurrences. Trophic changes invade the muscular fibres, which dwindle and exhibit degeneration of the contractile substance. The electrical irritability of the muscles is at first increased, but subsequently the reaction of degeneration is developed.

When mixed nerves are invaded by inflammation, sensation disappears earlier than the power of motion, and it is also the first to reappear during recovery.

Chronic neuritis is characterized by the same course and symptoms that are manifested by the acute form of the disease, but they are developed more gradually and with less severity. It is frequently associated with epilepsy, hysteria, and severe mental disorders.

Diagnosis. Neuritis must be distinguished from *neuralgia*, which may be recognized by the more intermittent character of its pain, and by the existence of pressure points. *Muscular rheumatism* is marked by a painful condition of the muscles, especially when they are subjected to pressure.

Prognosis. The duration of neuritis is frequently very tedious. In many cases recovery never occurs, and the cessation of inflammation is followed by permanent signs of injury. Many cases of acute neuritis

re followed by complete recovery, but there is always danger that the inflammatory process may invade the spinal cord.

TREATMENT. Treatment must be addressed to the causes of neuritis whenever they can be discovered and removed. *Local treatment* is greatly facilitated by perfect repose, and by the use of mercurial ointment, tincture of iodine, cups, blisters, and hypodermic injections of morphine for the relief of pain. The galvanic current is of great value in the treatment of neuritis. The anode should be placed over the region of pain, while the cathode rests upon an indifferent point. The use of the faradic brush is sometimes attended with considerable relief. Chronic cases are benefited by massage and by hot baths. The actual cautery may sometimes be applied with advantage.

Multiple Neuritis.

ETIOLOGY. *Multiple neuritis* consists in the wide diffusion of an inflammatory process which simultaneously invades many of the peripheral nerves. Its course is sometimes so rapid and so violent that it suggests an infective cause. In its chronic form it is undoubtedly caused in certain cases by an infective poison, *e. g.*, *beri-beri*, or *kake*, of the Japanese.

Multiple neuritis frequently occurs as a secondary consequence of such infective diseases as diphtheria, typhoid fever, malarial fever, syphilis, tuberculosis, etc. It frequently results from poisoning with lead and other metals. Alcohol, ergot, etc., frequently produce the disease, and its connection with injuries and exposure to cold scarcely needs mention.

SYMPTOMS. *Acute multiple neuritis* is frequently ushered in by the symptoms of fever. The seat of the disease is occupied by various forms of pain and paræsthetic modifications of sensation. There is complaint of weakness, stiffness, and difficulty of movement in the affected portions of the body. Sometimes complete paralysis is developed. The electrical irritability of the paralyzed muscles and nerves rapidly disappears, and the reaction of degeneration is soon apparent. Atrophy rapidly involves the affected muscles, and they may finally become contractured.

Sensory disturbances are less frequent and less extensively developed. *Vasomotor changes* involving the color and condition of the skin are frequently present. *The trophic functions* of the nerves are also disturbed. The hair becomes gray and increased in quantity over the affected parts, the nails become brittle and frequently fall off, the epidermis is thickened, and perspiration is often increased. Sometimes gangrene attacks the extremities; swelling of the joints and sheaths of the tendons frequently occurs.

The cutaneous and tendinous reflexes usually disappear, since the reflex path to the spinal cord is interrupted. Not unfrequently the affected nerves are sensitive to pressure. In certain cases the disease progresses widely, and death may result from invasion of the pneumogastric nerve. The sympathetic system itself may become involved, giving occasion for the incidence of so called visceral crises, characterized

by palpitation, vomiting, diarrhœa, and deep-seated visceral pain. The bladder and the rectum, however, almost always escape from implication in the disease.

PATHOLOGICAL ANATOMY. The inflammatory process in acute multiple neuritis is, in certain cases, principally located in the connective tissue, while in others the parenchyma of the nerves is chiefly involved. The changes correspond with those which have been already described in the section on neuritis. In certain cases the inflammatory process is disseminated throughout the nervous parenchyma, in the form of islets that leave considerable portions of tissue uninjured (segmental neuritis). The brain, spinal cord, and spinal nerve roots in uncomplicated cases exhibit no evidences of disease.

DIAGNOSIS AND PROGNOSIS. Acute and rapidly ascending cases of neuritis must be distinguished from *acute ascending spinal paralysis*, and from *poliomyelitis*, by the existence of sensory disturbances which are absent in those diseases. The prognosis is always serious on account of the danger of a fatal result from invasion of the pneumogastric nerve.

TREATMENT. Acute multiple neuritis should be treated with as large and as frequently repeated doses of salicylic acid as can be tolerated by the patient. Antipyrine, acetanilide, and phenacetine may also be given as required. Severe pain must be relieved by the internal use of opiates, with chloroform liniment externally. After the acute stage is passed, electricity should be applied to the affected nerves and muscles. Iodide of potassium is then useful; also treatment with baths and massage.

Toxic Paralysis.

Saturnine paralysis is one of the later symptoms of lead poisoning, though it occasionally appears at an earlier period of the disease. The symptoms develop gradually under the form of weakness, atrophy, and finally paralysis of certain muscles, especially those of the upper extremity, which are innervated by the radial nerve. Generalization of the paralysis rarely occurs. The disease ordinarily commences in the right arm, invading the common extensor muscles of the fingers; then follow the extensor muscles of the wrist and of the thumb; while the muscles of the ball of the thumb and the interosseous muscles are the last to yield. The supinator muscles are seldom invaded, unless the biceps, internal brachial, and deltoid muscles are also affected. The hand hangs perpendicularly from the extremity of the radius, producing the characteristic appearance known as *drop wrist*.

The muscles and nerves soon lose their excitability by the faradic current and the reaction of degeneration is rapidly developed. Partial retention of electrical excitability indicates the possibility of recovery within a comparatively brief period, but when the reaction of degeneration is fully developed, recovery is only possible after three or four months. The mechanical irritability of the muscles is increased, and fibrillary contractions are sometimes visible in the paralyzed muscles. The cutaneous and tendinous reflexes disappear, the muscles become atrophied, and trophic changes frequently occasion swelling of the phalangeal joints and tendinous sheaths.

PATHOLOGICAL ANATOMY. The muscular fibres dwindle, the nuclei the sarcolemma are multiplied, the connective tissue proliferates, and metimes undergoes fatty degeneration. The nerves undergo degenera-e atrophy to which, in all probability, the muscular changes are condary.

DIAGNOSIS. Lead palsy may be distinguished from *peripheral ralysis of the radial nerve* by the longer preservation of contrac-ity in the supinator muscles, and by the absence of any considerable nsory disorder.

PROGNOSIS. The prognosis is dependent upon the electrical reactions the muscles. Relapses are frequent, in consequence of repeated ex-sure to the poisonous influence of lead.

TREATMENT. Treatment must have reference to the removal of all uses by which lead can be introduced into the system. Iodide of tassium should be given in doses of five grains three times a day, in der to promote the removal of lead from the tissues. Hot sulphur ths should be ordered daily, and as a substitute for the natural waters, o or three ounces of sulphide of potassium may be dissolved in the th. Descending galvanic currents should be applied to the muscles ery day, and the faradic current may be employed whenever the uscles can be made to contract under its influence. Hypodermic jections of strychnine are frequently recommended.

Mercurial paralysis is frequently observed among laborers in quick-ver mines. It produces neither muscular atrophy nor any modifica-n in the electrical reactions, but disturbances of sensation are ap-rent. The *prognosis* is favorable, and the *treatment* should be the me as that which is recommended in cases of lead paralysis. Some-at similar paralytic conditions have been observed from the effects of *pper* and *zinc*.

Arsenical paralysis is usually the result of acute arsenical poison-g. It involves chiefly the lower extremities. The muscles become pidly atrophied, and painful disturbances of sensation accompany e course of the disease. Sometimes the bladder participates in the ralysis, and occasionally the upper extremities are invaded. The tensor muscles are principally affected, and the electrical reactions low the same course as in cases of lead poisoning. Recovery is dious and sometimes incomplete. The muscular fibres dwindle and hibit the appearance of waxy or fatty degeneration, which also in-lves the connective tissue. In certain cases the anterior cornua of e gray matter in the spinal cord is inflamed, but in the majority of ses the disease is limited to the peripheral nerves. The *treatment* is e same as for lead paralysis.

Phosphorus paralysis is observed in cases of poisoning with phos-horus. It takes the form of a partial paralysis involving one limb, or e lower extremities, and disturbances of sensation are also developed. he location of the disease is usually in the peripheral nerves, but some-

times the spinal centres are invaded. *Treatment* as in the preceding forms of paralysis.

Cases of paralysis are sometimes observed as a consequence of poisoning with *coal gas* or with the *vapor of carbon disulphide.*

Paralysis from ergot (ergotism) is observed after the use of spurred rye. It occasions muscular atrophy, severe pain, and other disturbances of sensation. The precise locality of the disease is still uncertain, and is possibly not the same in all cases.

Alcoholic paralysis frequently follows chronic indulgence in the use of alcohol. The extensors of the forearm and of the leg are chiefly involved by the disease, and it is accompanied by muscular atrophy and disturbances of sensation. *Tremor* is frequently observed in the paralyzed limbs, and the nerves and muscles are sensitive to pressure. *The electrical excitability* of the nerves and muscles is diminished, and frequently gives way to the reaction of degeneration. *Severe pain* and a great variety of *paræsthetic* sensations are often experienced, especially during the night-time. Various degrees of *hyperæsthesia* and *anæsthesia* may be developed. The *tendinous reflexes* disappear, but the cutaneous reflexes usually remain without change. The bladder and rectum are not involved in the disease. *Trophic changes* are sometimes observed, and the cerebral nerves are occasionally involved, especially the ocular nerves and the pneumogastric nerve. The *pupils* are frequently contracted or sluggish, and optic neuritis sometimes exists. *Intellectual disturbances* are of frequent occurrence, and there is great complaint of sleeplessness. *Ataxic symptoms* are frequently developed as a consequence of extensive peripheral neuritis (alcoholic pseudo-tabes).

Pathological Anatomy. Many of the nerve fibres are deprived of their medullary sheaths, and the nuclei of the sheath of Schwann are increased in number. In the muscles, the connective tissue is increased, and the muscular fibres have undergone atrophy. The spinal cord remains free from change.

Diagnosis. Alcoholic paralysis is frequently confounded with *tabes dorsalis*, in which disease the electrical excitability of the muscles and nerves is usually unchanged, and disordered pupillary reaction is frequently present; while in the alcoholic disease the girdle sensation and paralytic conditions of the bladder and rectum that are so common in tabes are absent.

Prognosis and Treatment. The *prognosis* depends largely upon the ability of the patient to resist his inclination for alcohol. The *treatment* should consist in the daily use of warm baths, with iodide of potassium, salicylic acid, and strychnine internally, accompanied by the use of electricity and stimulating frictions externally.

PART XI.

DISEASES OF THE SPINAL CORD AND MEMBRANES.

CHAPTER I.

PRELIMINARY CONSIDERATIONS.

SINCE the *spinal cord* does not occupy the whole extent of the spinal column, but terminates between the first and second lumbar vertebræ, diseases which occupy the spinal column below that point do not involve the spinal cord but the *cauda equina*. It is also desirable to remember that the cervical and lumbar portions of the spinal cord are considerably thicker than the dorsal portion. The *cervical swelling* occupies the space between the upper border of the atlas and the second thoracic vertebra, while the *lumbar enlargement* extends from the tenth dorsal vertebra to the first lumbar vertebra.

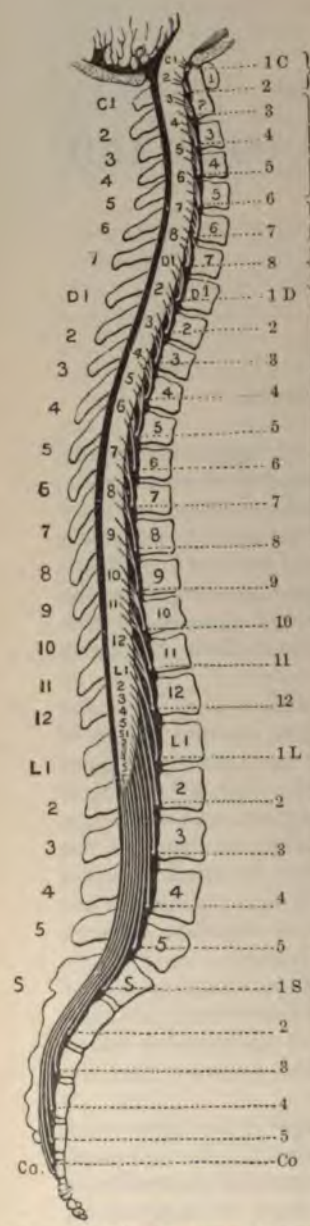
Since the *spinal nerves* follow a descending course as they leave the spinal cord to enter the inter-vertebral canals, their internal points of origin are considerably above the level of their apparent emergence along the sides of the spinal column. (Fig. 155.) *The eight cervical nerves* have their origin between the foramen magnum and the sixth cervical vertebra. *The twelve dorsal nerves* originate between the seventh cervical vertebra and the tenth dorsal. *The five lumbar nerves* originate between the tenth dorsal vertebra and the lower portion of the twelfth dorsal vertebra; while *the five sacral nerves* originate between the twelfth dorsal vertebra and the first lumbar vertebra.

The *spinal dura mater* is not closely applied to the inner surface of the bony canal, but is widely separated from it by fatty tissue that contains numerous veins. For this reason diseases of the vertebra which invade the sub-dural space may lead to dangerous pressure upon the spinal cord.

Spinal diseases are not always followed by changes in the spinal cord that can be recognized with the naked eye after death. Microscopical examination of fresh specimens which have been teased with needles in a three-quarter per cent. solution of chloride of sodium, or in glycerine, should not be neglected. Such specimens may also be treated with osmic acid, or may be stained with carmine or other colors before being subjected to examination.

But in a large proportion of cases, careful and methodical hardening

FIG. 155.



	Motor.	Sensory.
1 C	Sterno-mastoid.	Neck and scalp.
2	Trapezius.	Neck and shoulder.
3	Rhomboids and rotators of humerus.	
4	Diaphragm.	
5	Deltoid, biceps, brachialis, supinators.	Outer aspect of arm and forearm.
6	Serratus.	
7	Triceps, extensors of wrist and fingers, and pronators.	Anterior and posterior aspects of arm, forearm, outer half of hand, and 2½ fingers.
8	Flexors of wrist and long flexors of fingers.	
1 D	Intrinsic muscles of hand.	Inner aspect of arm, forearm, inner half of hand, and 2½ fingers.
2		
3		
4		
5		
6	Intercostal muscles.	Front of thorax. Ensiform cartilage.
7	Abdominal muscles.	
8		
9		
10		Abdomen. Umbilicus. Buttock, upper part.
11		
12		
1 L		
2	Flexors, hip.	Groin and scrotum (front).
3	Extensors, knee.	Thigh: Outer side, Front side, Inner side
4	Adductors	
5	Abductors (Hip.)	Leg, inner side. Buttock, lower part.
1 S	Extensors (?) (Hip.)	Back of thigh.
2	Flexors, knee (?)	Leg and foot, except inner part.
3	Muscles of leg moving foot.	
4	Perineal and anal muscles.	Perineum and anus.
5		Skin from coccyx to anus.
Co		

Diagram and table showing the approximate relation to the spinal nerves of the various reflex functions of the spinal cord. (After GOWERS.)

e cord is necessary before it can be microscopically examined. For roper methods of preparing and mounting specimens, full direc- are given in the text-books on histology and the use of the scope.

e diagnosis of spinal diseases must necessarily be dependent first, the location of the disorder, and second, upon the determination e nature and cause of the local lesion. The character of the onal disturbance which follows a spinal lesion is but slightly de- nt upon the nature of the lesion. It merely expresses the extent severity of the injury to which the structures of the cord have subjected either by violence or by disease. Hence the great im- nce of the localization of symptoms which is rendered possible by hysiological investigations of modern times. In the gray matter e anterior cornua of the spinal cord may be distinguished three ate groups of large ganglionic cells, which may be differentiated as terior, a middle, and an external group, which, by the axis cylinder sses of their constituent cells, give origin to the fibres of the an- spinal nerve roots. Their injury produces paralysis and rapid ng of the muscles with which they are directly connected, accom- d by the reaction of degeneration in the paralyzed nerves and les. Similar consequences follow injuries of the anterior spinal roots which convey motor and trophic impulses to the muscles, , joints, and tendons with which they are connected.

the posterior cornua of the gray matter, the ganglionic cells are ouped in clusters, but are scattered throughout the gray matter. That possess trophic functions is apparent from the fact that their injury sorder leads to trophic changes and gangrene of the skin with they are in communication.

ing in the isthmus that connects the anterior and posterior cornua olumn of large ganglionic cells called the *vesicular column* (Clark's n). The processes of these cells are connected with the *direct al tract* in the postero-lateral portion of the cord; but their pre- unction is unknown.

e white substance (Fig. 156) of the cord is divided into :

The *direct pyramidal tract*, which consists of fibres (d.P.) that not decussated in the medulla oblongata, but which accomplish their sation in the anterior commissure of the cord.

The *crossed pyramidal tract* (cr. P.), which consists of longitudinal from the brain, which have completed their decussation in the lla oblongata, and enter into communication with the ganglionic in the anterior cornua.

The *direct cerebellar tract* (C.b.)

The *funiculus cuneatus* (r.z.) (column of Burdach), which consists y of commisural fibres that connect together the different segments e posterior cornua. They finally terminate in the nucleus of the lus cuneatus and in the olivary body.

The *funiculus gracilis* (cr. s.lr.) (column of Goll), which consists y of fibres that originate in the inter-vertebral ganglia and termi- n the nucleus of the funiculus gracilis upon the floor of the fourth

ventricle, from which new fibres pass onward to the tegmentum, corpora quadrigemina, and thalamus.

The *posterior spinal nerve roots* send a portion of their fibres directly into the substance of the posterior cornua, while the remainder pass through the funiculus cuneatus before they enter the posterior cornua. A decussation of the sensory path takes place immediately after its entrance into the cord, so that injury of one-half of the spinal cord is followed by loss of motion upon the same side and loss of sensation upon the opposite side of the body. The fibres which convey impressions of *tickling* cross first; then follow the fibres that convey *painful* impressions; and finally those which convey impressions of *temperature*. Those fibres which are concerned with the *muscular sense* remain uncrossed. *Tactile* impressions find their way to the brain through the posterior columns of the cord, while *painful* impressions pass upward in the gray matter.

FIG. 156

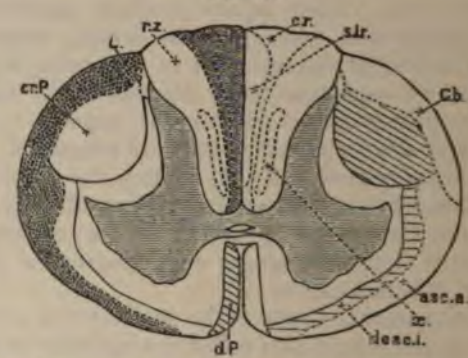


Diagram to illustrate the general arrangement of the several tracts of white matter in the spinal cord. (SHERRINGTON.)

cr.P. Crossed pyramidal tract. *d.P.* Direct pyramidal tract *Cb.* Cerebellar tract. *s.lr.* and *cr.* Indicate the median posterior tract. *asc.a.l.* The antero-lateral ascending tract. *desc.l.* The antero-lateral descending tract. *L.* Lissauer's zone.

In certain conditions of disease *reflex movements* may be either increased, weakened, or altogether abolished. Their increase occurs whenever injury or disease involves the inhibitory fibres that lie in the pyramidal tracts and connect the central convolutions of the brain with the gray matter of the anterior cornua of the cord. Reflex movements are weakened or abolished whenever any portion of the reflex arc between a sensory nerve end-organ and the corresponding muscles is impaired or completely interrupted.

Vasomotor functions are disturbed by diseases or injuries of the spinal cord. The vasomotor paths are supposed to lie in the lateral columns, from which nerve fibres pass into the gray matter of the cord, and thence emerge with the anterior nerve roots, and find their way to the bloodvessels. These paths do not appear to undergo decussation. In the gray matter of the cord are undoubtedly situated independent

vasomotor centres which can influence the bloodvessels without the intervention of the brain.

In the lowest portion of the lumbar division of the cord, near the level of the emergence of the third and fourth sacral nerves, is situated the *ano-vesical centre* which innervates the muscles of the bladder and rectum. In its immediate neighborhood is the spinal centre for *erection* and *ejaculation*. In the lower portion of the cervical and the upper portion of the dorsal cord is situated a spinal centre which influences the *movements of the pupils*. From this centre emerge fibres, through the anterior nerve roots, which enter the cervical portion of the sympathetic nerve, and finally reach the iris. Irritation of this centre produces dilatation of the pupil; and its paralysis is followed by pupillary contraction, upon the same side with the injury. This form of *spinal myosis* is frequently observed in spinal diseases, and is characterized by the fact that the pupil does not react under variations of light, but does vary during movements of accommodation.

It appears that the large ganglionic cells in the anterior cornua are not grouped in connection with single nerves, but that they are connected by their fibres with muscular groups which perform similar functions. (See Fig. 155.) Thus it appears that:

The fourth cervical nerve innervates the supra- and infra-spinatus muscles, and probably the teres minor muscle.

The fifth cervical nerve innervates the biceps and supinator muscles, and probably the internal brachialis and supinator muscles.

The sixth cervical nerve innervates the sub-scapular, pronator, teres major, latissimus dorsi, pectoralis major, triceps, and serratus magnus muscles.

The seventh cervical nerve innervates the extensor muscle of the hand.

The eighth cervical nerve innervates the flexors of the hand.

The first dorsal nerve innervates the interosseous and other small muscles of the hand.

The third lumbar nerve innervates the adductors and flexors of the thigh.

The fourth lumbar nerve innervates the extensors of the knee.

The fifth lumbar nerve innervates the flexors of the leg.

The first and second sacral nerves innervate the glutæus muscles, the muscles of the calf and external surface of the leg, and the extensor and small muscles of the foot.

The third sacral nerve contains the erigent nerve fibres, and innervates the levator ani muscle.

The fourth sacral nerve innervates the muscles of the bladder and rectum.

Lesions of the spinal cord at the level of the twelfth dorsal vertebra, involve the lower portion of the lumbar enlargement, and produce paralysis of the muscles innervated by the sciatic nerve, with the exception of the tibialis anticus. The bladder and rectum are frequently paralyzed, and the reflexes are abolished. Anæsthesia occupies the lower limb, with the exception of the external and inner surfaces of the

thigh and the inner surface of the leg, which are innervated by the anterior cutaneous, crural, and obturator nerves.

A lesion in the upper part of the lumbar enlargement produces motor and sensory paralysis of the entire lower extremity.

A lesion of the dorsal portion of the cord, at the level of the eighth dorsal vertebra, produces paralysis of the lower extremity, anæsthesia as high as the navel, increase of the reflexes, and priapism.

A lesion at the level of the fifth dorsal vertebra produces similar consequences, and also an extension of anæsthesia to the level of the ensiform cartilage.

A lesion in the lower portion of the cervical cord produces paralysis of everything below, and of the muscles in the upper extremity that are innervated by the ulnar nerve; while anæsthesia reaches the upper portion of the thorax.

A lesion in the cervical cord extending from the fifth to the eighth cervical nerves produces an extension of paralysis to the muscles that are innervated by the radial nerve, with the exception of the supinator longus.

A lesion in the upper portion of the cervical enlargement of the cord, involving the fourth and fifth cervical nerves, produces paralysis of the arm, body, leg, diaphragm, and anæsthesia extending upward to the level of the clavicle, together with an increase of the reflexes.

Diseases of the spinal cord are said to be *systematized* when they are limited to certain ganglionic groups, or are restricted to particular columnar paths in the white substance of the cord.

When different portions of the spinal tissue are indiscriminately involved the disease or injury is said to be *unsystematized*. Systematized diseases may be *simple* when only one functional group or tract is involved, or *combined* when several are simultaneously invaded. Diseases which are accompanied by no discoverable changes in the tissues are termed *functional diseases* of the spinal cord.

CHAPTER II.

DISEASES OF THE SPINAL MENINGES.

External Inflammation of the Spinal Dura Mater—Pachymeningitis Spinalis Externa.

Pathological Anatomy. Tubercular and syphilitic diseases of the spinal column may originate an inflammatory process upon the external surface of the dura mater, in the loose connective tissue that connects it with the bony structures of the spinal column. It is occasionally excited by other inflammatory diseases in the neighborhood. It usually occupies a circumscribed portion of the dura mater, generally its posterior surface. The ordinary evidences of exudation are present

ration sometimes occurs and may result in caseation or in exten-
ickening and adhesion of the affected tissues. Sometimes the
surface of the dura mater and the pia mater participate in the
matory process.

MPTOMS. The symptoms may be referred to irritation of the
nerve roots, followed by paralysis, and, in certain cases, by com-
on and secondary inflammation of the spinal cord. The disease
ences with a sensation of *stiffness in the back*, sensitiveness to
re upon the spinous processes of the vertebræ, and pain when a
onge, or the galvanic cathode, is moved up and down the spine.
ently a sense of *constriction around the body* results from irrita-
f the posterior nerve roots. Not unfrequently paroxysms of *neu-
orm pain* are experienced, and are accompanied by *spasms* and
ctures in the muscles of the extremities. *Various paræsthetic
lers of sensation* frequently exist, and, during the paralytic stage
disease, *anæsthesia* is developed. *Muscular paralysis, atrophy,*
he *reaction of degeneration* follow compression of the anterior
roots. If the spinal cord itself is compressed, motor and sensory
legia, paræsthesia, exaggeration of the reflexes, and disorder of
nctions of the *bladder and rectum* are developed, and *bedsores*
ccur. The disease assumes a chronic form, and is usually fatal,
h recovery has been sometimes observed.

EATMENT. Treatment must depend, in great measure, upon the
of the disease. Its general course should be that which will be
bed in the section on myelitis.

ıal Inflammation of the Spinal Dura Mater—Pachymeningitis Spinalis Interna.

THOLOGICAL ANATOMY. *Internal spinal pachymeningitis* is an
ımation and extensive proliferation of the connective tissue, in-
g the inner surface of the dura mater, and usually extending to
achnoid membrane and the pia mater. It is generally restricted
lower portion of the cervical enlargement of the cord, and prin-
y involves the posterior part of the membranes. It produces
ression of the spinal nerve roots at the seat of the disease, and it
lso occasion similar pressure upon the spinal cord itself. In cer-
ases the inflammatory exudation contains blood, which may be
d in considerable quantity, constituting *hemorrhagic pachymen-
s*. This condition is frequently associated with similar states of
rebral dura mater. It generally results from chronic alcoholism,
m insanity.

MPTOMS. The disease is chronic, and during the first two or three
ıs the symptoms principally indicate *irritation* of the affected
s, which is finally succeeded by *paralysis* and *muscular atrophy*.
ring the *stage of irritation* pain is experienced in the upper part
spinal column, in the occiput, and in the joints of the upper ex-
ies. The spinous processes are not tender on pressure, but there
nsation of stiffness in the neck, and of constriction around the
k. The painful sensations are liable to paroxysms of aggravation,

and various forms of hyperæsthesia and paræsthesia may be remarked, especially in the upper extremities. *Trophic changes*, in the form of cutaneous eruptions, are frequent. *Muscular spasms* of a tonic or clonic character are not uncommon, and the muscles become rigid and contractured.

During the *paralytic stage* of the disease, fibrillary contractions, muscular paralysis, atrophy, and the reaction of degeneration are developed. The skin becomes anæsthetic. Since the disease usually involves the lower portion of the cervical cord, paralysis chiefly affects the median and ulnar nerves, so that the flexor muscles of the hand and wrist are paralyzed, while the intact radial nerve maintains the extensor muscles of the hand in a state of contraction. The hand is, therefore, drawn into a position of dorsal extension, while the second and third phalanges of the fingers are flexed in consequence of the paralysis of the interosseous muscles. If, on the contrary, the disease extends upward so as to involve the entire cervical plexus, the extensor muscles of the forearm are paralyzed, and the hand drops at the wrist.

Compression of the spinal cord produces the usual paralytic conditions that are developed below the seat of pressure.

DIAGNOSIS. Pachymeningitis may be differentiated from *progressive muscular atrophy* by the symptoms of irritation which characterize its earlier stages; by its limitation to the cervical portion of the cord; and by the subsequent development of the symptoms of pressure-paralysis below the seat of the disease. In like manner it may be distinguished from *amyotrophic lateral sclerosis*, in which sensory disturbances and nervous irritation are absent; and in which death usually results by extension of the disease to the medulla oblongata. *Tubercular diseases and tumors* involving the spinal column and meninges must be differentiated by attention to their history and progress.

TREATMENT. The treatment of pachymeningitis is the same as that of acute or chronic myelitis.

Acute Spinal Meningitis—Meningitis Spinalis Acuta.

ETIOLOGY. *Acute spinal meningitis* is an acute inflammation of the arachnoid membrane and pia mater of the spinal cord. It sometimes involves the spinal membranes alone, but it may extend to the corresponding membranes of the brain; or cerebral meningitis may be propagated downward until it involves the membranes of the spinal cord, constituting what is termed *cerebro-spinal meningitis*. These combined forms of the disease are occasioned either by tubercular or by special infection. The ordinary forms of spinal meningitis are excited by exposure to cold, by injuries involving the spinal column and membranes, or by the extension of inflammatory diseases from other portions of the body, or as a result of infective diseases, or from menstrual or hæmorrhoidal suppression.

PATHOLOGICAL ANATOMY. *Meningeal inflammation* is characterized by a stage in which the phenomena of *hyperæmia* are most conspicuous. This is succeeded by a period of *exudation*; and the last stage of the disease is occupied by the processes of *reabsorption and recovery*.

The products of exudation may be either simply fibrinous, or they may contain pus and blood corpuscles in greater or less quantity. The *medulla oblongata* is rarely involved in the process. Though recovery may frequently occur, thickening and adhesion of the meninges often persist, and may lead to serious consequences. In certain cases the dura mater and neighboring connective tissue participate in the inflammatory processes. The nerve roots and the substance of the spinal cord itself are usually more or less involved, since the pia mater sends numerous processes into the interior of the cord. The white matter is more extensively invaded than the gray, but in both tissues it is not an uncommon event to discover evidences of proliferation in the neuroglia and swelling of the ganglionic cells.

SYMPTOMS. *Spinal meningitis* is ushered in by vague disturbances of the system which culminate usually in a severe chill, followed by high fever, with a temperature of 103° or 104° F. *Pain and stiffness* are experienced along the spinal column, but are not increased by pressure upon the spinous processes, or by the application of a hot sponge or the galvanic cathode. During the *period of congestion and irritation* of the spinal nerve roots there is complaint of neuralgiform pains which radiate along the nerves of the body and of the extremities. There is exaltation of cutaneous sensibility, and the muscles are very sensitive to pressure. *Motor irritation* is indicated by tonic or clonic muscular spasm, or by the development of rigidity and muscular contraction, especially in the territory of the extensor muscles. The cervical muscles exhibit tonic contracture, and the head is drawn backward, so that in certain cases the body rests upon the occiput and the sacrum alone. The patient dreads movement of every kind, and his position cannot be shifted without occasioning great distress. The act of respiration is rendered difficult by the rigidity of the muscles of the body. Urine and feces are retained in consequence of the spasmodic condition of the sphincters of the bladder and rectum. The pupils are contracted or irregular, in consequence of irritation of the cilio-spinal nerves.

The disease may subside without further progress, but in many cases *the stage of paralysis* is now gradually developed, though many of its symptoms frequently appear during the period of irritation and excitement. *Anæsthesia and analgesia* now succeed to the previous sensory exaltation. The muscles relax, grow weaker, finally become paralyzed, and exhibit the reaction of degeneration. The reflexes disappear, the detrusor muscle of the bladder becomes paralyzed, causing retention of the urine, and at last the sphincter also gives way, causing incontinence of urine.

Recovery is still possible, though *paralysis and atrophy* may persist permanently in certain muscular groups. The principal danger to life is developed when the inflammatory process extends upward and involves the medulla oblongata. The functions of respiration, circulation, speech, and deglutition are gradually paralyzed, and death follows from asphyxia, cardiac paralysis, or excessive elevation of the temperature.

of the impossibility of exertion; while in meningitis bo
attended with great pain, and the patient is motionles
of the suffering that attends muscular effort. Myeli
attended by trophic changes in the skin, and by speedy
bladder and decomposition of the urine, disorders which
late period, if at all, in meningitis.

PROGNOSIS. The duration of the disease is frequ
though sometimes it passes into a chronic form, and
or months, or may leave traces of its existence during
always a dangerous disease, especially when the neig
medulla oblongata is approached.

TREATMENT. Acute spinal meningitis should be t
myelitis.

Chronic Spinal Meningitis—Meningitis Spinali

ETIOLOGY. *Chronic spinal meningitis* may be the r
form of the disease, or it may gradually develop as a
causes identical with those which produce the acute
holism, syphilis, leprosy, chronic diseases attended w
the blood, and chronic diseases of the spinal cord,
causes of chronic meningitis.

PATHOLOGICAL ANATOMY. *Chronic meningitis* usu
lower portion of the spinal membranes, and is frequen
in circumscribed patches of inflammation. It is
thickening of the membranes, which sometimes underg
ossification. The inflamed tissues become deeply pig
herent to each other. The spinal fluid is increased
becomes more or less turbid with degenerated cells an
The intra-spinal processes of the pia mater are thicker

asioned by the development of bedsores, or by cystitis and ammoni-
ia. The treatment should be the same as that for acute myelitis.

inal Meningeal Hemorrhage—Hæmorrhagia Meningelis Spinalis.

Meningeal hemorrhage is frequently caused by diseases of the spi-
l column, or of the structures within the spinal canal. It may
o result from the rupture of an aneurism, or from a hemorrhage
thin the cranium from which blood has found its way into the spinal
nal. It is not uncommon as a consequence of convulsions and spas-
odic diseases that terminate fatally, and it may occur by reason of
gnation of the blood, or in connection with infective diseases when
ey assume a hemorrhagic character. The seat of hemorrhage is
ually in the loose peri-dural connective tissue between the bony walls
the spinal canal and the dura mater (epi-dural hemorrhage). It
ay occur within the cavity between the dura mater and the arachnoid
embrane (sub-dural hemorrhage), or it may occupy the sub-arachnoid
ace where the normal cerebro-spinal fluid lies (sub-arachnoid hemor-
age).

SYMPTOMS AND DIAGNOSIS. *Consciousness* remains unaffected in
es of spinal meningeal hemorrhage. There is complaint of sudden
alized pain in the spine, with girdle sensations, and neuralgiform
ns in the body or extremities, according to the seat of hemorrhage.
e spinous processes are not sensitive to pressure, but there is a *feeling
stiffness* in the muscles of the back or of the neck, if the hemor-
age be high up. The usual symptoms of irritation of the sensory
ve roots are followed, after a time, by *motor and sensory paralysis*
pressure increases within the spinal canal. If the disease be suffi-
ntly prolonged, the *muscles become atrophied*, and exhibit the *reac-
n of degeneration*. The *reflexes disappear*, the *bladder and rectum
ome paralyzed*, cystitis and bedsores may be developed. The
ease may continue from two to eight weeks, or longer, though death
netimes occurs from shock at a very early period. If the region of
medulla oblongata be invaded, the characteristic disturbances of
culation, respiration, and pneumogastric function appear. Some-
es meningitis is excited.

PROGNOSIS AND TREATMENT. The *prognosis* is comparatively favor-
e, since recovery not unfrequently occurs when the medulla ob-
gata escapes injury. The *treatment* should be the same as that
ich will be described under the head of spinal hemorrhage.

Tumors of the Spinal Meninges—Neoplasmata Meningealia.

Every variety of neoplasm may be developed in connection with the
nal meninges, either as a primary disease or as a secondary manifes-
on of malignant disease in other parts of the body. Tumors may be
nected with any one of the spinal membranes, though usually
ached to the dura mater. They are usually of an oval form, and
ir dimensions are extremely variable.



processes elsewhere, are succeeded by the symptom
tation of the spinal nerves and compression of the
of the neoplasm may be readily determined by th
painful and paræsthetic symptoms are principal
prognosis is usually unfavorable, though surgic
recently been attempted, with a favorable result.

CHAPTER III.

FUNCTIONAL DISEASES OF THE SPI

Spinal Irritation—Irritation Spin

SYMPTOMS. *Spinal irritation* is indicated by
column, neuralgiform pains in the skin and vis
secretory disturbances, and muscular debility, some
functional disorder of the brain, without any org
nervous structures. The disease is not unfrequently
exhaustion, or cerebral weakness. The most const
which usually occupies the dorsal vertebræ, thoug
whole length of the spine. It is greatly aggravate
spinous processes, or by the application of a hot sp
current. The symptoms of *irritation in the peri*
exhibited in any portion of the body, or in the
chiefly of *sensory parœsthesia* associated with

nd his pupils. Iron, quinine, and cod-liver oil are of service in cases f anæmia, and galvanism should be applied daily with gentle currents long the spine. Nervines and tonics afford temporary and partial elief.

Acute Ascending Spinal Paralysis—Paralysis Ascendens Acuta.

ETIOLOGY. This rare disease (Landry's paralysis) is more frequent among men than among women, and is usually encountered during middle life. Its causes are unknown, though it is probably dependent upon an unrecognized contagion, since the course of the disease, the accompanying enlargement of the spleen, and swelling of the intestinal lymph follicles and mesenteric lymph glands, together with the absence of characteristic lesions in the nervous system, indicate the probability of some form of infection.

SYMPTOMS. The disease is frequently ushered in by fever, and soon presents the phenomena of a *rapidly progressive ascending spinal paralysis*. It begins in the feet, invades the muscles of the legs, thighs, loins, abdomen, back, and thorax; then involves the muscles of the hands, forearm, upper arm, neck, throat, and face. *Spastic symptoms* do not appear, and the paralyzed muscles are completely flaccid. The patient is soon confined to bed, and is speedily deprived of the power of motion. *Inspiration* becomes difficult, and the *accessory expiratory muscles* fail. Deglutition and speech become more and more difficult, food and liquids regurgitate through the nasal passages, the pulse is enfeebled and accelerated, and death is preceded by the symptoms of asphyxia. During the whole course of the disease the *electrical reactions* of the paralyzed muscles remain unchanged. *Cutaneous sensibility* is but slightly modified, and *trophic disorders* are not developed. The *bladder and rectum* preserve their functions, though emptied with considerable difficulty, by reason of the paralytic condition of the abdominal muscles. *The reflexes* gradually disappear. Typical cases run their course without fever. *Enlargement of the spleen* and *albuminuria* are commonly observed. *Consciousness* is maintained through the whole course of the disease.

Death usually occurs during the second week, though life may be terminated within two or three days, or it may be prolonged for many weeks; the fatal result is usually caused by bulbar paralysis. Recovery occasionally happens, though convalescence is very tedious, and is often interrupted by relapses which may lead to a fatal termination.

DIAGNOSIS. *Ascending myelitis*, with which acute ascending paralysis may be confounded, differs by the presence of fever; disturbances of sensation; paralysis of the muscles, bladder, and rectum; bedsores; and loss of electrical excitability. All forms of *poliomyelitis* exhibit rapid wasting of the muscles and loss of electrical excitability. *Acute polyneuritis* is attended by serious disturbances of sensation and by the rapid disappearance of electrical reaction in the nerves and muscles that are paralyzed.

TREATMENT. Since syphilis sometimes precedes the disease, an active course of mercurial inunction, with iodide of potassium inter-

nally, should be employed. Counter-irritants may be applied to the spine, and weak galvanic currents should be employed for five minutes each day. Our ignorance of the nature and causes of the disease renders rational treatment impossible, and it becomes necessary to attempt the relief of symptoms only, as they arise.

Reflex paralysis. *Reflex paralysis* is a term that has been applied to certain cases of paralysis associated with peripheral diseases, usually involving the intestinal tract or the urogenital apparatus. Similar cases have also been observed in connection with gunshot wounds of the nerves, diseases of the joints, and as a consequence of exposure to cold. The discovery of the fact that peripheral neuritis may follow an ascending course and may lead to inflammatory conditions of the spinal cord has deprived these cases of much of their former characteristic importance. It is probable that in the majority of so-called reflex paralyses they are dependent upon actual changes of an inflammatory and degenerative character, involving the peripheral nerves and their spinal connections. In the small minority of cases which cannot be thus explained it is probable that changes of structure exist which are not yet recognizable by the present methods of research.

Psychic spinal paralysis. Spinal paralysis sometimes follows the occurrence of intense mental excitement, fright, grief, and shock. In such cases the bladder and rectum remain unharmed, but sensory disturbances are usually observed, together with a greater or less degree of muscular weakness or paralysis. The disorder is functional in its character, and is relieved by rest, massage, electricity, restoratives, and tonics.

Writer's Cramp.

ETIOLOGY. *Writer's cramp* usually occurs during middle life, among men of a delicately organized constitution who have been exhausted by overwork, poverty, dissipation, or misfortune, and whose occupation requires excessive effort in the coördination of the smaller and weaker muscles of the extremities. The disease is frequently termed *professional cramp*, since it is not confined to writers, but is encountered among all classes of workmen who occupy much time in the manner already described. It is commonly observed among clerks, musicians, watchmakers, tailors, shoemakers, weavers, and others whose occupation requires constant coördination of the delicate muscles.

SYMPTOMS. The symptoms of the disease are gradually developed in the smaller muscles of the hand, and in the extensors and flexors of the forearm. The muscles of the upper arm, shoulder, and neck may also participate in the disorder.

Three varieties of the disease may be distinguished: a spastic, a tremulous, and a paralytic form. *The spastic variety* is most common. *The paralytic form* is least frequently observed.

Spastic writer's cramp is characterized by tonic, and occasionally, by clonic muscular spasms involving the muscles of the fingers and thumb, rendering it difficult or impossible to use the pen. *The spas-*

nodic or tremulous form of the disease is characterized by muscular remors which occur during the act of writing, and render the script nore or less illegible. *The paralytic form* of the disease is character-zed by a sense of fatigue in the affected muscles, and by the impossi-bility of executing necessary movements.

Writer's cramp is aggravated by all forms of mental excitement as well as by convergence of the attention upon the disorder. Generally, muscular power is not affected, and the muscles of the hand are not enfeebled. Their capacity for ordinary movement and exertion in any other occupation than that of writing remains unchanged. Their *electrical excitability* generally remains unmodified, though the nerves with which they are connected sometimes exhibit a reversal of the ordinary galvanic reactions. In certain cases *spasmodic disturbances* invade other groups of muscles, and squinting, stuttering, and similar disorders may exist. *Sensory disturbances* and perversions may be developed, and in certain cases *vasomotor derangement* has been witnessed.

Little or nothing is known regarding the anatomical basis of Writer's cramp. The *diagnosis* of the disease is easy; its *prognosis* unfavorable, since relapses are frequent, even after a considerable period of rest. Even though the patient may have laboriously acquired the art of writing with the other hand, the disease soon invades its muscles, and his condition is as bad as ever.

TREATMENT. Complete rest of the wearied muscles is necessary for long period of time. Every effort must be made to invigorate the constitution, and to improve the general health. The effects of injuries or of local inflammations involving the nerves must be removed. A moderate galvanic current should be applied to the spine for five minutes every day. Tonic forms of the disease may be benefited by application of the galvanic anode to the affected muscles, while in paralytic and tremulous forms the cathode should be similarly applied, or the faradic current may be employed; though obviously that should not be applied to the muscles in spastic forms of the disease. Great benefit may be obtained from skilful massage. The usual methods of counter-irritation and friction with liniments, etc., are of comparatively little value. Temporary benefit is sometimes derived from the use of thick-stalked pens or other mechanical contrivances.

Tetany.

ETIOLOGY. *Tetany* is characterized by the paroxysmal occurrence of tonic muscular spasms involving particular muscular groups, and associated with an increase of the mechanical and electrical excitability of their motor nerves. It occurs most frequently among children and young people, especially those who are endowed with a rachitic and enfeebled constitution. It is frequently excited by exposure to cold and by other ordinary causes of nervous disease. It sometimes occurs endemically in boarding-schools and other similar collections of people, and it is more common in certain territorial localities than in others.

SYMPTOMS. The spasmodic paroxysms of tetany are usually preceded by *paræsthetic sensations* in the extremities, and, in certain cases,

by dizziness and other *cerebral disorders of sensation*. The *spasms* are bilateral and are usually limited to the flexor muscles of the fingers and hand, though they may extend to the flexors and adductors of the whole extremity. In like manner the corresponding groups of the lower extremities may be affected. In certain instances the muscles of the body may be involved, and in the severest form of the disease the muscles of the head, face, eyes, tongue, pharynx, larnyx, and diaphragm may participate in the spasm. The fingers and thumb, during the spasm, are drawn together into a characteristically conical form, and the great toe is forcibly flexed and adducted under the other toes. Occasionally the extensor and abductor muscles are affected, so that the fingers and toes are spread apart. The muscles are slightly sensitive to pressure, and fibrillary contractions are visible through the skin. The period of spasm is frequently accompanied by various painful sensations and by disorder of the special senses.

Spasmodic paroxysms may be very easily excited by compression of the muscles of an extremity with a bandage, or by pressure upon an artery in the limb. In this way latent forms of the disease may sometimes be unmasked. The *electrical excitability* of the motor nerves is also exaggerated, so that weak faradic currents produce muscular contractions; and the application of weak, galvanic currents produces excessive contraction. The inordinate excitability of the motor nerves by *mechanical irritation* can be readily demonstrated by tapping the nerve trunks with the finger or with a percussion hammer. The extraordinary excitability of the facial nerve may be easily demonstrated by drawing the finger rapidly over the skin between the eye and ear, so as to make pressure upon the principal branches of the nerve. The muscles themselves do not exhibit any increase of excitability on direct mechanical irritation.

Cutaneous sensibility is not particularly changed. *Painful pressure-points* exist along the spinal column. The general health is not seriously injured, though dyspeptic difficulties and intestinal disorders, with their usual consequences, are generally present. The duration of single paroxysms of the disease may vary from a few seconds to many hours, or even two or three days; and the frequency of the paroxysms is equally variable.

The disease usually terminates in recovery, though death occasionally results with convulsive phenomena, or it may occur as a consequence of exhausting diarrhœa.

Tetany is a *functional disease*, since the trifling hemorrhagic effusions and other irregular pathological appearances which have been observed in the spinal cord are merely the accidental consequences of convulsion, rather than causes of the disease. It is probably a spinal disorder of a functional character, conditioned by an increased irritability of the ganglionic cells in the anterior cornua.

DIAGNOSIS. Tetany can be differentiated from *tetanus*, which begins with symptoms of trismus, a symptom that is absent in tetany. *Hysterical convulsions* do not exhibit the characteristic excitability of the nerves that is observed in tetany. *The spasms* which are observed

s a consequence of *ergotism* closely resembles the disease, but may be ifferentiated by reference to their cause.

TREATMENT. The treatment of tetany should be chiefly guided by eference to its causes. Dyspeptic disorders and the presence of para- tes require particular attention to the condition of the alimentary anal. Cases associated with prolonged lactation, or other causes of xhaustion, require appropriate measures for their relief. Rheumatic atients should be treated with salicylic acid, iodide of potassium, and ot-air baths. Suppression of the menses or of hæmorrhoidal discharges equires the application of cups and leeches, together with hot foot- aths. The paroxysms may be relieved by the administration of bromide f potassium, chloral hydrate, and ethereal remedies. Valerianate of mmonia, opiates, and other nervines are frequently administered; but he principal attention must be given to the patient during the intervals etween the paroxysms, when the application of gentle galvanic currents long the spine is of great benefit.

Congenital Myotonia—Myotonia Congenita.

ETIOLOGY. *Congenital myotonia* (Thomsen's disease) is characterized y a painless, tonic contraction of the voluntary muscles which persists or several seconds after they have been in any way excited to action, nd consequently interferes considerably with the locomotion of the mbs. It is a disease which exists as an hereditary disorder in certain amilies.

SYMPTOMS. The symptoms of the disease are manifested in the erritory of the voluntary muscles, usually in those of the lower ex- remities, though all of the other voluntary muscles may be involved. t becomes impossible for the patient to perform rapid movements; the and that is clasped around the barrel of a gun, or any other object, annot be immediately relaxed. If the patient is directed to open the outh, several seconds elapse before the movement can be executed. *Electrical excitation* of the muscles does not exhibit any increase of rritability, but the muscular spasm which follows their contraction per- ists from ten to thirty seconds before relaxation follows. The motor erves react normally to both faradic and galvanic currents. *Mechani- al irritability* of the motor nerves is diminished, while that of the uscles is increased.

The symptoms are increased in severity by excitement, fatigue, ex- osure to cold, and feverish conditions; but they are diminished by oderate exercise, warmth, and the use of alcohol. The disease con- inues during the whole of life, and is unattended by any danger.

The *muscular fibres* are increased in size, the nuclei of the sarcolemma re increased in number, and the muscular substance itself exhibits acuolation and considerable obliteration of its striæ. The interstitial *onnective tissue* is slightly increased. Still it is probable that the isease is of central origin, since it is frequently associated with spasms nd spinal symptoms which may be aggravated by cerebral excitement.

The disease may be distinguished from *muscular hypertrophy* by he presence of modifications of mechanical and electrical irritability, as

well as by the persistence of voluntary muscular contraction, circumstances that are not observed in the hypertrophic disease.

TREATMENT. Gymnastic exercises, massage, baths, and electricity afford the only known means of relief. Internal remedies exert no influence upon the disease.

Paramyoclonus Multiplex.

This disease is characterized by paroxysms of clonic spasm, usually involving symmetrical muscles, without otherwise influencing their nutrition, their mechanical or electrical excitability, their strength, or their power of coördination. The electrical reactions of the motor nerves are also normal. The disease is usually observed among hysterical or nervous persons who have suffered from fright, or from other depressing causes. The muscular contractions follow one another fifty or sixty times in a minute, or even oftener. In certain cases one muscle only is involved in the spasm, while in other cases groups of muscles may be affected. When the diaphragm and other abdominal muscles are involved, a noisy, panting respiration is audible, like that of a dog after running. Sensory disturbances are generally absent. The reflexes are either unchanged or slightly increased. The disease is unattended with danger, and generally yields to galvanization of the spinal cord.

CHAPTER IV.

UNSYSTEMATIZED DISEASES OF THE SPINAL CORD.

Spinal anæmia may be produced by local conditions which interfere with the circulation of the blood within the cord, or it may be the result of hemorrhage, of wasting discharges, and of chlorotic and anæmic conditions that affect the general circulation. Under such circumstances, the spinal vessels are imperfectly filled, and the nutrition of the ganglionic cells and nerve fibres is deteriorated. The functions of the cord are reduced in vigor, and in severe cases may be more or less completely abolished. In chronic cases which depend upon impoverishment of the blood, muscular power is reduced, sensation may be either exalted, modified, or wholly abolished, and the reflexes are exaggerated. The indications for treatment point to the adoption of such measures as will increase the quantity and quality of the blood, and will improve the circulation.

Spinal hyperæmia is usually associated with a hyperæmic condition of the spinal meninges. It may be either *active* or *passive*. The first form is encountered as a consequence of exposure to cold, concussion, inflammation, excessive muscular exertion, infective disease, menstrual or hæmorrhoidal suppression, and poisoning with carbonic oxide, alcohol, strychnine, etc.

Passive hyperæmia of the *spinal cord* exists in connection with e general stagnation of the blood that accompanies cardiac and pul-nary or abdominal diseases.

Spinal hyperæmia occasions feelings of pressure, tension, and pain in e spinal region. Hyperæsthesia, paræsthesia, local spasms, exalted re-x irritability, and increased galvanic excitability occur without the velopment of fever. The symptoms are subject to rapid variation, d are frequently overlooked in consequence of their association with mptoms of cerebral hyperæmia.

The indications for treatment call for the employment of vigorous unter-irritation with cups along the spinal column, leeches at the us, and hot mustard foot-baths. The bowels must be kept freely en; the diet must be moderate and unstimulating. Hydropathy is equently of great service. Ergot and belladonna may be administered ternally by those who have confidence in their efficacy.

Spinal Hemorrhage—Hæmorrhagia Medullæ Spinalis.

ETIOLOGY. *Primary spinal hemorrhage* is caused by injuries, by posure to cold, by excessive excitement, and muscular exertion, by gnation of blood in consequence of diseases of the heart, lungs, or er, and by previous diseases of the spinal cord or of its neighboring ructures.

Secondary hemorrhage is generally dependent upon previous in-mmation of the spinal cord.

PATHOLOGICAL ANATOMY.—*Hemorrhage* usually occurs in the cer-al or dorsal portions of the cord. It generally involves the anterior rnua and occupies a circumscribed space within the substance of the rd. Sometimes blood finds its way, for a considerable distance, between e bundles of nerve fibres, but this is unusual. In recent cases the od is clotted, and the neighboring tissue is softened and stained by flammation. In old cases the clot is encapsulated by proliferation of e connective tissue, which transforms the hemorrhagic effusion into cyst-like cavity, the so-called *apoplectic cyst*. After slight hemorrhage simple pigmented mass of cicatricial tissue remains when the blood s been removed by absorption.

Spinal hemorrhage is frequently followed by changes in the me-nges, and by inflammation and secondary degeneration in the cord elf.

SYMPTOMS AND DIAGNOSIS. A sudden hemorrhage is followed by e immediate development of *paralysis*, which varies according to the vel and extent of effusion. In the majority of cases the symptoms dicate complete destruction of the functions below the seat of lesion, t in certain cases only one-half of the cord appears to be involved, a limited group of cells, usually those in the anterior cornua, give gns of paralysis.

The disease is usually ushered in by severe pain at the point of emorrhage. *Paralysis* is immediately developed, usually in the lower tremities (paraplegia), though occasionally involving both extremities

upon the same side (spinal hemiplegia), or only one limb (monoplegia). The nerves of *sensation* and the *bladder* and *rectum* are also paralyzed, and the *muscles* are flaccid. The *reflexes* are at first more or less completely abolished, but after a time they may reappear, and they exhibit considerable exaggeration when the hemorrhagic effusion is situated above the lumbar portion of the cord. The *paralyzed muscles* become rapidly atrophied, and the reaction of degeneration is developed when the anterior cornua are destroyed. Involuntary *spasms* frequently occur in the muscles of the lower extremities when the lumbar portion of the cord is not involved in the lesion. *Vasomotor* and *trophic disturbances* are rapidly developed in the paralyzed extremities, and blood and albumin frequently appear in the urine. *Consciousness* is not affected unless the phenomena of shock are developed. *Fever* rarely ever occurs, unless cystitis and bedsores complicate the case. *Death* may result very speedily when the hemorrhage is seated in the upper portion of the cord. *Paralysis of the phrenic nerves* and *dyspnœa* are occasioned by hemorrhage at the level of the fourth and fifth cervical nerves. In many cases death results at a late period in consequence of bedsores and septic poisoning, or by reason of the development of cystitis and ammoniacal decomposition of the urine.

PROGNOSIS. The prospect of recovery is very unfavorable for, though life may not be destroyed, the process of cicatrization is followed by permanent paralysis and contracture of the affected muscles.

TREATMENT. In cases attended by the symptoms of spinal hyperæmia, cups should be applied to the back, and leeches to the anus. The diet must be simple and unstimulating; the bowels must be relieved each day. Chapman's spinal ice-bags should be applied to the spinal column, in order to effect a permanent reduction of temperature and contraction of the bloodvessels at the seat of hemorrhage. Iodide of potassium should be given in five-grain doses three times a day, to promote absorption. After about two months, when all acute symptoms have disappeared, the galvanic current may be applied in alternate directions along the spinal cord for ten minutes every other day. The back should be sponged with alcohol several times a day, and if any indications of the formation of bedsores make their appearance, the patient should lie upon a water-bed.

Acute Inflammation of the Spinal Cord—Myelitis Acuta.

ETIOLOGY. *Acute myelitis* is more frequent among men than among women, and is usually encountered during middle life. The primary form of the disease is excited by exposure to cold and damp (rheumatic myelitis). It frequently results from injuries, and from the suppression of menstrual or hæmorrhoidal effusions. It has been ascribed to severe mental excitement, and to excessive debauchery, but in many cases no apparent cause for the disease can be discovered.

Secondary myelitis is frequently dependent upon previous diseases of the spinal column or meninges. It is a usual consequence of compression of the cord, and it may result from previous diseases of the spinal cord itself, or from the extension of migratory neuritis to the

cord. It is not uncommonly observed as a complication of the infective diseases and of chronic wasting disorders.

Pathological Anatomy. *Acute myelitis* commences in the vessels and neuroglia, or in the connective tissue, and extends rapidly to the nervous elements themselves. It generally attacks the dorsal portion of the cord before invading the cervical and lumbar regions. The gray matter in the majority of cases first undergoes inflammation, which may remain thus circumscribed, or may finally extend into the white substance of the cord. The whole diameter of the cord is sometimes invaded, but in certain cases the seat of inflammation may occupy only one-half of its section. It may occupy a considerable extent of the cord, or it may be disseminated in the form of inflammatory islets that are surrounded by healthy tissue. Cases have been observed in which the peripheral portion of the cord was alone inflamed, though such cases are usually associated with inflammatory conditions of the spinal meninges.

The portion of the cord that is occupied by inflammation becomes softened, though softening alone affords no indication of inflammation, since it may be the result of post-mortem changes. In recent or acute cases the softened portions of the cord are reddened by excessive distention of the bloodvessels and by hemorrhagic effusions. As the processes of absorption and fatty degeneration of the products of inflammation proceed, the softened portion assumes a yellowish color, which finally becomes gray in consequence of the deposit of pigment in the cicatricial tissues. At the last stage of the disease, secondary inflammation may proceed upward and downward from the original seat of inflammatory action.

Microscopical examination indicates the occurrence of inflammation in the vascular walls; the lymph channels contain red and white blood-corpuscles; the neuroglia exhibits evidence of proliferation; the medullary sheaths of the axis-cylinders are broken up, undergo granular degeneration, and disappear. The axis-cylinders themselves swell and exhibit nodular changes of form. They lose their normal fibrillar structure, become vacuolated, undergo granular degeneration, and disappear. The ganglionic cells lose their characteristic fibrillary and granular structure, become vacuolated and deprived of their processes. Their nuclei become indistinct, and frequently undergo subdivision. Fatty degeneration and disappearance of the entire structure finally occur. The diseased cells become deeply pigmented, and, if not totally destroyed, are transformed into small globular masses that are destitute of processes. Numerous white blood-corpuscles, or wandering cells, distended with fat globules make their appearance. They are probably connected with the function of absorption, and gather up the fatty débris of the tissues for transportation into the lymph-vessels. Certain amyloid bodies which resemble grains of starch also become visible, but nothing is known regarding their nature. The lymph-vessels and spaces are frequently occupied by a colloid substance which appears to be coagulated exudation. Broken-down red blood-corpuscles and crystallized or amorphous masses of blood pigment are strewed at random over the field of observation.

The *membranes of the cord and of the spinal nerve roots* usually participate in the inflammatory process. The corresponding peripheral nerves and muscles also exhibit signs of degeneration. Bedsores form in consequence of inflammation in the posterior cornua, and the urinary passages become inflamed, giving occasion for ammoniacal decomposition of the urine.

In certain very rare cases, actual *suppuration of the spinal cord* has been discovered as a consequence of acute myelitis. Occasionally inflammation is followed by the development of *cysts* within the substance of the cord. When the connective tissue undergoes extraordinary proliferation, the process has been described under the name *myelitis hyperplastica*. In many cases inflammation subsides into a chronic form, accompanied by the development of *chronic sclerosis*, characterized by atrophy of the nervous elements and by predominance of the connective tissue.

SYMPTOMS. *Acute myelitis* is usually developed rapidly, with the symptoms of fever which, in children, may be ushered in by convulsions. Sensations of formication, numbness, fatigue, and shooting pain, are frequently accompanied by retention of the urine. *Pain* is experienced in that portion of the spinal column which corresponds to the seat of the disease. It is frequently aggravated by movement, or by pressure upon the spine, or by the application of hot sponges or galvanism over the backbone. A sense of constriction is often experienced, as if some portion of the body were surrounded by a tight band corresponding to the irritated sensory nerve roots at the level of the inflammation. At the commencement of the disease, besides pain and cutaneous hyperæsthesia, muscular *spasms* and *contracture* are frequently observed before the development of paralytic symptoms. In certain cases severe pain is experienced after the occurrence of complete motor and sensory paralysis (anæsthesia dolorosa).

Flaccid paralysis of the muscles corresponds to the situation and extent of the spinal lesion. At first the muscles appear unchanged, but after a time they become wasted from disease; and if the trophic cells in the anterior cornua are destroyed, or if the anterior nerve roots are invaded, muscular degeneration occurs. The *electrical reactions* exhibit corresponding changes.

Cutaneous sensibility diminishes and finally disappears. Retarded conduction of impressions, and other disturbances of sensation, sometimes accompany the progressive reduction of sensibility. *Vasomotor* and *trophic disturbances* are also developed. The paralyzed limbs are at first warmer and more highly colored than usual, but subsequently they become pale and cold. The epidermis exfoliates, and bedsores appear over the sacrum and over other bony prominences in the lower extremities. Extensive inflammation of the lower portion of the spinal cord occasions the disappearance of the reflexes. When the lesion is situated at a higher level, the reflexes in the lower extremities are exaggerated. The *urine* becomes bloody, albuminous, turbid, and ammoniacal. The *bladder* and *rectum* are completely paralyzed when the lumbar portion of the cord is involved. Urine may be retained by reason of paralysis of the detrusor muscle, or it may dribble away in

consequence of paralysis of the sphincter muscle. When both muscles are paralyzed, continual dribbling may occur from the over-filled bladder. In like manner, constipation of the bowels may be succeeded by involuntary evacuations. Inflammation of the upper portion of the dorsal division of the cord is frequently accompanied by the occurrence of priapism.

DIAGNOSIS. Myelitis may be distinguished from *acute spinal meningitis* by the fact that in the meningeal disease symptoms of paralysis are less conspicuous, and the evidences of pain on movement of the spinal column are excessive. *Hemorrhage of the spinal cord and meninges* is suddenly developed, and is unattended by symptoms of irritation. Landry's *acute ascending paralysis* closely resembles ascending myelitis, but is characterized by more rapid progress, and by the absence of change in the electrical reactions. In cases of *multiple neuritis* electrical excitability of the paralyzed muscles and nerves rapidly disappears. *Hysterical paralysis* is usually observed in women, and is accompanied by other symptoms of hysteria.

PROGNOSIS. The course of acute myelitis is exceedingly variable. It may assume a rapid and violent form, speedily terminating in death, or it may linger for weeks and months. In many cases the consequences of the disease are permanent. Complete recovery is scarcely ever observed.

TREATMENT. When acute myelitis is dependent upon syphilis it should be actively treated with daily inunctions of mercurial ointment and the use of iodide of potassium, in five-grain doses three times a day. This should be continued for six or eight weeks, and then, after an intermission of a month, a second course of inunction should be instituted. In many cases two or three such repetitions may be recommended. Even in non-syphilitic cases this method often gives the best results.

When menstrual or hæmorrhoidal suppression has preceded the disease, leeches and cups should be applied over the sacrum.

The diet must be simple and unexciting. Great attention must be given to the condition of the bed, and the position of the patient should be changed several times each day, so as to avoid the effects of pressure. The back should be rubbed with alcohol, and if any portion of the skin becomes reddened by pressure, it must be protected by the application of adhesive plaster, and a water-bed should be procured. If bedsores form, they should be antiseptically dressed, in accordance with the rules of surgery. The bladder must be emptied three times a day with a perfectly clean catheter. The effects of dribbling from the bladder must be obviated by the use of appropriate receivers for the urine, and the skin must be carefully cleansed in order to prevent bedsores. When ammoniacal decomposition of the urine occurs, ten grains of salol may be prescribed every two hours, and the bladder should be irrigated every day. The bowels must be carefully regulated, and perfect cleanliness must be secured.

Local treatment should consist at first in the application of Chapman's ice-bags to the spine. Their rubber surface should never be allowed to touch the skin, but must be separated from it by a layer of

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DIAGNOSIS. Myelitis may be distinguished from *acute spinal meningitis* by the fact that in the meningeal disease symptoms of paralysis are less conspicuous, and the evidences of pain on movement of the spinal column are excessive. *Hemorrhage of the spinal cord and meninges* is suddenly developed, and is unattended by symptoms of irritation. Landry's *acute ascending paralysis* closely resembles ascending myelitis, but is characterized by more rapid progress, and by the absence of change in the electrical reactions. In cases of *multiple neuritis* electrical excitability of the paralyzed muscles and nerves rapidly disappears. *Hysterical paralysis* is usually observed in women, and is accompanied by other symptoms of hysteria.

PROGNOSIS. The course of acute myelitis is exceedingly variable. It may assume a rapid and violent form, speedily terminating in death, or it may linger for weeks and months. In many cases the consequences of the disease are permanent. Complete recovery is scarcely ever observed.

TREATMENT. When acute myelitis is dependent upon syphilis it should be actively treated with daily inunctions of mercurial ointment and the use of iodide of potassium, in five-grain doses three times a day. This should be continued for six or eight weeks, and then, after an intermission of a month, a second course of inunction should be instituted. In many cases two or three such repetitions may be recommended. Even in non-syphilitic cases this method often gives the best results.

When menstrual or hæmorrhoidal suppression has preceded the disease, leeches and cups should be applied over the sacrum.

The diet must be simple and unexciting. Great attention must be given to the condition of the bed, and the position of the patient should be changed several times each day, so as to avoid the effects of pressure. The back should be rubbed with alcohol, and if any portion of the skin becomes reddened by pressure, it must be protected by the application of adhesive plaster, and a water-bed should be procured. If bedsores form, they should be antiseptically dressed, in accordance with the rules of surgery. The bladder must be emptied three times a day with a perfectly clean catheter. The effects of dribbling from the bladder must be obviated by the use of appropriate receivers for the urine, and the skin must be carefully cleansed in order to prevent bedsores. When ammoniacal decomposition of the urine occurs, ten grains of salol may be prescribed every two hours, and the bladder should be irrigated every day. The bowels must be carefully regulated, and perfect cleanliness must be secured.

Local treatment should consist at first in the application of Chapman's ice-bags to the spine. Their rubber surface should never be allowed to touch the skin, but must be separated from it by a layer of

times a day), or Fowler's solution of arsenic (four
day), are of considerable service. The use of ele
commenced; the paralyzed muscles should be farad
vanic currents may be applied to the spine for fiv
every other day.

During convalescence the patient must be wa
effects of over-exertion. Moderately warm baths
must be employed with great moderation in the ma
frequency.

Chronic Inflammation of the Spinal Cord—M

The causes of chronic inflammation of the spin
that produce acute inflammation. Why they s
rapidly in one case than in another is not clearly u

PATHOLOGICAL ANATOMY. *Chronic myelitis* oft
in the spinal cord that can be recognized only by t
scope. When visible changes exist they cause
density of the affected tissues, which also appear
gray color, by reason of an increased deposit of pi
inflammation usually occupies the dorsal portion of
limited portion is invaded it is termed *circumscrib*
the whole diameter of the cord is inflamed it is
myelitis; and when isolated patches of inflammatio
random in the cord, it is termed *multiple* or *di*
When the gray matter alone is inflamed it is
myelitis.

The *microscopical appearances* differ chiefly fr
observed in acute myelitis by the greater prolife
tissue and by the presence of amyloid bodies, while
which are so conspicuous in acute inflammation are le
The nerve roots are atrophied and sclerosed, and th

Motor paralysis comes on gradually, with feelings of fatigue and pid exhaustion after muscular movement. The lower extremities are longer under the complete control of the will, and finally the power locomotion is lost. Usually the disease attacks the lower extremities, d may after a time invade the upper extremities, life being terminated last by paralysis of the bulbar nerves. The bladder and rectum are equently paralyzed at an early stage of the disease. The *reflexes* d the *electrical reactions* of the nerves and muscles follow the same urse that is observed in acute myelitis. In the later stages of the isease the paralyzed muscles become contractured, and the tendinous eflexes are exaggerated as the lateral columns of the cord are invaded y the disease.

Exacerbations of the disease are not uncommon. Its duration may e protracted through a number of years. Intercurrent infective dis-ases sometimes exert a favorable influence upon the course of chronic yelitis, but complete recovery scarcely ever occurs. Death may result om exhaustion, septicæmia, ammoniæmia, or from the extension of the isease to the medulla oblongata. The *treatment* is the same that is rescribed for acute myelitis.

mbolic and Thrombotic Softening of the Spinal Cord—Myelomalacia Embolica et Thrombotica.

From those forms of softening which are dependent upon inflammation f the spinal cord, must be distinguished certain cases that are produced y obstruction of the spinal bloodvessels with *emboli* or *thrombi*. Care-il examination of the bloodvessels is very necessary, in order to ascer-in the nature of such softening, since the color and consistence of the fected portion depends upon the vascularity of the part, and upon the ry variable amount of effusion and pigmentation that has accompanied e process. Considerable confusion may exist in consequence of the ct that inflammatory softening may produce thrombosis in the adjacent oodvessels, while embolic or thrombotic softening may also excite a condary inflammation in its immediate vicinity. Minute and circum-ribed lesions can exist without symptoms, but when the seat of disease volves any considerable portion of the cord, the symptoms of acute yelitis are developed.

Multiple Cerebro-spinal Sclerosis—Sclerosis Cerebro-spinalis Multiplex.

Etiology. *Multiple cerebro-spinal sclerosis* usually occurs during e first half of adult life. It is frequently encountered among mem-rs of neurotic families, and it is apparently excited by the ordinary uses of spinal inflammation.

Pathological Anatomy. The disease consists in the formation of *attered centres of inflammation*, which are irregularly distributed in e substance of the brain and spinal cord. Their number is exceed-gly variable, and their size differs from that of a microscopical point that of a mass measuring several inches in extent. They may be

generally recognized as salmon-colored tumors of a firmer consistency than that of the surrounding tissue. Sometimes they protrude above the surface, but frequently they are somewhat retracted. Their form is often as irregular as their distribution. The floor of the fourth ventricle, the pons Varolii, the white substance of the brain around the cerebral ventricles, and the white substance of the spinal cord and cerebellum are the favorite seats of development for these sclerotic masses. The cerebral nerves and the spinal nerve roots are also often invaded. Sometimes the membranes of the cord exhibit evidences of circumscribed inflammation and adhesion. Those muscles which are in connection with portions of the cord that have become sclerosed undergo atrophy and degeneration.

Microscopical examination reveals changes similar to those which occur in chronic myelitis. The interstitial connective tissue proliferates at the expense of the nervous elements. The axis-cylinders, though swelled and distorted, persist sometimes through the whole course of the disease.

SYMPTOMS. So extensive and so irregular is the distribution of the islets of sclerosed tissue that a corresponding variety of symptoms is inevitable. In certain cases cerebral symptoms preponderate, in others spinal symptoms are most prominent, and their nature varies according to the seat of the most extensive and overwhelming lesions, since they are displayed by those external organs that are in communication with the central foci of the disease.

Cerebro-spinal sclerosis usually commences with vague and indefinite symptoms of pain, headache, dizziness, disordered digestion, and unusual fatigue after exertion. The lower limbs gradually become enfeebled, and the characteristic symptoms of the disease are developed. These consist in the occurrence of peculiar muscular agitation in connection with voluntary movement (volitional tremor), nystagmus, scanning speech, paresis, and apoplectiform attacks.

Volitional tremor accompanies every voluntary exertion on the part of the patient. The attempt to carry a glass of water to the mouth usually results in spilling a considerable portion of the liquid. The act of writing becomes almost impossible, and the chirography is characteristically illegible. These movements cease when the muscles are at rest.

Nystagmus and the *scanning pronunciation* of words are, in like manner, dependent upon muscular tremor accompanying voluntary movements of the ocular and vocal muscles. The head also shakes when unsupported, and the movements of respiration exhibit a similar intermittent course when the patient is excited, since, under such circumstances, muscular contraction assumes a somewhat voluntary character.

Apoplectiform and, occasionally, *epileptiform seizures* may occur during the course of the disease. They are frequently followed by symptoms of fever and by temporary paralysis which disappears in the course of a few days.

Disturbances of *sensation* are neither common nor conspicuous. In certain cases the phenomenon of *allocheiria* have been observed, that is,

nsory impressions upon one side of the body are erroneously referred the other side.

The *muscles* are enfeebled, but seldom undergo complete paralysis. *pasmodic contractions* are sometimes observed, especially during voltary effort, and contractures are gradually developed in the muscles f the neck and in the lower limbs which are so strongly adducted and exed as to render locomotion impossible. In certain cases the rigidity f the lower extremities produces a spastic gait like that which is bserved in spastic spinal paralysis. When the posterior columns of ne cord are affected, the ataxic symptoms of tabes dorsalis appear.

The *cutaneous* and *tendinous reflexes* are generally exaggerated. A light tap upon the tendons produces an excessive muscular response. nkle clonus may be readily developed by suddenly pressing the foot nto a position of extreme dorsal flexion.

Paralysis of the *bladder* and *rectum* sometimes occurs, and may be ccompanied by cystitis and all its dangerous consequences.

Vasomotor and *trophic disturbances* are sometimes developed, and he *electrical reactions* are disordered.

In certain cases the medulla oblongata is invaded by the disease and he nuclei of the bulbar nerves become sclerosed. The phenomena of *ulbar paralysis* then appear. Speech, deglutition, respiratory and ardiac movements are gradually disordered and paralyzed, and death nay result from the intrusion of food into the larynx, or from other onsequences of bulbar paralysis.

When the other cerebral nerves are invaded by the disease, the *pecial senses* and *ocular movements* in like manner experience disrder and progressive paralysis. More or less complete deafness, yosis, mydriasis, double vision, temporary blindness, and reduction of ne visual field, not unfrequently occur. Spinal myosis is less common nan in tabes dorsalis.

There is frequent complaint of *dizziness* and *vertigo* which are often ependent upon diplopia. The *emotional nature* manifests serious hanges, and many cases are finally merged in total insanity.

The disease may persist for many years. Cases of thirty years' duraon have been recorded. Their course is frequently attended by alterate remissions and exacerbations, but recovery never occurs, and eath results either from exhaustion, or during the course of an apolectiform attack, or as a consequence of bedsores, or bulbar paralysis, r by reason of some intercurrent disease.

DIAGNOSIS. The diseases with which multiple cerebro-spinal sclesis may be confounded are paralysis agitans, chorea, athetosis, and remor from other causes. *Paralysis agitans* is a disease of old age, and iffers in the fact of the persistence of tremor in muscles which are at est. It is also diminished by voluntary effort.

Chorea is characterized by the greater breadth and irregularity of nuscular movements. It is usually a disease of children.

Athetosis is characterized by the existence of paralysis and contracures in the affected limbs; and the movements are more gradually eveloped and more irregular than those which accompany sclerosis.

Ordinary tremors are characterized by the very limited extent of

the muscular excursions, and by the fact that they may be generally referred to old age, cachexia, or alcoholic intoxication.

In certain rare instances the symptoms of cerebro spinal sclerosis exhibit the characteristics of a purely functional disease unattended by any discoverable lesions in the spinal cord, while in other cases extensive lesions have been demonstrated after death, though the characteristic and pathognomonic symptoms had not been observed during life. Sometimes the disease presents a remarkable likeness to the features of *tabes dorsalis*, but a careful comparison of symptoms will usually reveal characteristic differences in the behavior of the pupils, and in the condition of the tendinous reflexes. It is sometimes quite impossible to avoid confusion of the disease with cases of *progressive paresis of the insane*. *Amyotrophic lateral sclerosis* also presents many points of similarity, but it usually commences in the upper extremities.

TREATMENT. The general treatment for chronic myelitis suffices in the majority of cases of cerebro-spinal sclerosis. Extension of the spinal column by suspension has sometimes been followed by partial improvement.

Tumors of the Spinal Cord—Neoplasmata Medullæ Spinalis.

Tumors involving the substance of the spinal cord are rarely observed. They may reach considerable size without the appearance of notable symptoms. In certain cases their growth occasions the phenomena of acute or chronic spinal disease without the occurrence of anything to indicate that such symptoms depend upon the existence of a tumor. Sometimes they occasion sudden hemorrhage and corresponding consequences. According to the location of the disease will be the character of the symptoms, sometimes involving one or more of the columnar tracts of the cord, or in other cases indicating an invasion or compression of its total diameter. Occasionally the resulting nervous symptoms may be so closely connected with the function of other organs—for example, the respiratory apparatus—that their spinal origin is entirely overlooked.

Cavities in the Spinal Cord—Syringomyelia et Hydromyelia.

Cavities in the substance of the spinal cord are either congenital or of later origin. In certain cases they extend the whole length of the cord; in others they are circumscribed within very narrow limits, and their form exhibits great irregularity. Their contents usually consist of a clear, serous fluid that is rarely stained with blood or other constituents. The cavity is sometimes surrounded by an imperfectly developed capsule, but in other cases it possesses no clearly defined boundary. When a cavity has its origin in a dilatation of the central canal of the cord, it is lined with cylindrical epithelium. Its immediate vicinity is often occupied by patches of inflammation; and sometimes the neighboring vertebræ are in a carious condition.

Such cavities are frequently produced by dilatation of the central canal as a consequence of peri-ependymal sclerosis or other obstruction

circulation. In certain cases they result from the softening and rption of tumors (gliomata), or of the products of inflammation. geal adhesion frequently exists in their neighborhood.

Fig. 157.



Syringomyelia. Gangrene of the fingers. (Church.)

symptoms are exceedingly obscure, and in many cases entirely observation. In certain cases slowly progressive atrophy has bserved in the upper extremities, associated with profound modi- s in the power of perceiving variations of temperature and im- ns of pain. Vasomotor and trophic changes, involving the station of cutaneous eruptions and symmetrical gangrene of the and extremities (Morvan's disease), together with abolition of ndinous reflexes, and the occasional development of muscular y and contracture, have been described. (Fig. 157.) Bulbar sis not unfrequently terminates the course of the disease, which, y respects, closely resembles certain of the phenomena of leprosy.

CHAPTER V.

TRAUMATIC DISEASES OF THE SPINAL CORD.

ncussion of the Spinal Cord—Commotio Medullæ Spinalis.

OLOGY. *Concussion of the spinal cord* has its origin in such f violence as affect its functions without producing palpable in- of the spinal column or meninges. It is frequently associated e phenomena of shock, and is a common consequence of railway

accidents and other violent commotions. There is often evident a great want of proportion between the nervous symptoms and the discoverable lesions; in short, the psychical phenomena frequently outweigh the physical changes. For this reason the term *traumatic neurosis* seems particularly appropriate. Alcoholism, excessive use of tobacco, debauchery, hereditary influences, and the various predisposing causes of nervous disease, favor the occurrence of traumatic neurosis after comparatively slight injuries. The disease is sometimes developed as a consequence of the terror and excitement that accompany the anticipation of injury, even though an actual collision may have been averted. Such cases are occasionally observed among railway servants who have been thus exposed to imminent risk without actual bodily harm.

PATHOLOGICAL ANATOMY. In cases of early death after *pure spinal concussion* no visible changes can be discovered. Sometimes points of hemorrhage are visible in the spinal cord and in the meninges. At a later period the evidences of chronic meningitis, or myelitis, or of both diseases are sometimes apparent.

SYMPTOMS AND DIAGNOSIS. In certain cases the ordinary phenomena of shock are followed by speedy death; in other instances convalescence is gradually established and results in complete recovery; while in a third class of cases recovery occurs only after many months.

Sometimes an injury is followed by no conspicuous symptoms, and the patient congratulates himself upon his fortunate escape; but after a variable period of time the evidences of *spinal irritation* or of *paralysis* are gradually developed. Thus may be originated various forms of spinal disease which resemble chronic myelitis, multiple sclerosis, spastic paralysis, tabes dorsalis, and other spinal affections. The *intellectual faculties* sometimes give evidence of deterioration, and there is complaint of headache, insomnia, excessive debility, cardiac disturbance, and various psychical disorders. The *eyes*, in certain cases, exhibit optic atrophy and pupillary disturbances, or contraction of the visual field, and color blindness.

Like other spinal diseases such cases follow a very tedious course, and sometimes are terminated by death.

PROGNOSIS. Excluding all cases of deception and malingering, the prognosis is unfavorable; though patients of an hysterical temperament who have suffered spinal concussion may recover completely after some new and engrossing object of interest has engaged their attention. So long as the patient is oppressed by anxieties regarding the future, or regarding the settlement of claims for damages which may have been brought into the courts, the prospect for recovery is unfavorable, and it is vastly improved by the removal of all such forms of psychical agitation.

TREATMENT. During the early stage of spinal concussion the treatment of *shock* must be instituted. Stimulants and restoratives may be freely administered. *Traumatic neurosis* may be treated with electricity, massage, the rest-cure, and hydropathy. *Inflammatory symptoms* require the treatment for acute or chronic myelitis.

Compression of the Spinal Cord—Compressio Medullæ Spinalis.

Etiology. *Compression of the spinal cord* may result from the pressure that is exercised by tumors, inflammatory exudations, or diseases of the spinal column and meninges, which invade the spinal canal and limit its capacity.

Pathological Anatomy. *Compression of the spinal cord* produces a reduction in its magnitude at the point of pressure, and the constituent columns of the cord are flattened and atrophied to a degree that may occasion the complete disappearance of nervous elements. *Secondary inflammatory changes* are developed in the columns of the cord above and below the seat of compression; and the course of these degenerative processes corresponds with the direction of the functional movements which they represent; thus *degeneration* in the course of the pyramidal tracts is downward from the point of compression, while above the lesion it follows the opposite direction in the posterior columns and in the cerebellar tracts. The nerve roots and intervertebral ganglia become inflamed and atrophied, and the spinal meninges also become thickened and, sometimes, extensively inflamed.

Symptoms and Diagnosis. The disease is ushered in by various *disturbances* of *sensation*, together with tenderness on pressure, and other evidences of local changes in the bones of the spinal column. After a time the symptoms of *irritation* are developed in the form of neuralgic pains and girdle-sensations, which are in many instances worse at night than during the daytime, and are aggravated by movement of the body. Various forms of *hyperæsthesia* and *paræsthesia* are manifested; and *trophic disturbances* take the form of cutaneous eruptions, bedsores, or inflammation of the joints. *Muscular spasms* and *contracture* are frequently observed. Gradually, *paralytic symptoms* become prominent. The muscles are flaccid, and locomotion becomes impossible, though passive movements may still be resisted. Sometimes, when the cervical portion of the cord is involved, the arms alone are paralyzed, in consequence of compression involving the nerve roots rather than the spinal cord itself. In certain cases this is probably due to compression of the anterior cornua of the gray matter, or because the nerve paths to the upper extremities lie nearer to the periphery of the cord, and are more easily compressed, than those which descend to the lower extremities. The functions of the bladder and rectum are affected in a manner similar to what is observed in transverse myelitis.

Cutaneous anæsthesia is gradually developed, although it seldom becomes complete. Retardation of sensory impressions is sometimes observed. In certain cases the phenomena of anæsthesia dolorosa are manifested. This is a not uncommon incident in the course of cancerous diseases of the spinal column.

When the *anterior nerve roots* are affected, the muscles with which they communicate undergo atrophy and exhibit the reaction of degeneration; while on the contrary, if the substance of the cord alone be subjected to pressure, reflex excitability is considerably increased, and the phenomena of ankle clonus are easily excited; but, if the lumbar portion of the cord is subjected to serious pressure, these reactions dis-

appear, in consequence of interruption of the reflex arc within the cord.

Vasomotor disturbances are sometimes observed in the paralyzed limbs.

Complete recovery may occur, even after severe paralysis, when the nerve elements of the cord have been in any way relieved from pressure before atrophy has destroyed their functional capacity. In many cases, though recovery never occurs, the symptoms present alternate improvement and aggravation; but frequently the disease progresses steadily until it reaches a fatal termination.

The development of *secondary degeneration* in the different columns of the cord is followed by the appearance of corresponding symptoms. Invasion of the lateral columns causes the previously flaccid muscles of the lower extremities to become rigid and contractured, so that the limbs are excessively flexed and adducted. The upper extremities sometimes become paralyzed at a late period, by reason of the upward extension of secondary degeneration to the cervical portion of the cord.

PROGNOSIS. The prognosis is usually unfavorable, though it is least so in cases that depend upon diseases which sometimes admit of recovery, as, for example, tuberculosis of the spinal column.

TREATMENT. When compresion has been caused by injuries of the spinal column, it may sometimes be relieved by surgical operations for the reduction of dislocation, or for the removal of fractured portions of the vertebræ. In a few cases tumors have been successfully removed from the dura mater. In the majority of cases, however, the treatment of chronic myelitis is all that can be undertaken.

Injuries of the Spinal Cord.

PATHOLOGICAL ANATOMY. Changes in the cord that are produced by injuries correspond to the nature of the traumatism and to the length of time which has elapsed since their infliction. Swelling, softening, pigmentation, and fatty degeneration of the wounded tissues take place, and in cases of recovery cicatrization occurs. It is possible that sometimes a certain amount of regeneration of the nerve elements may be effected. Old injuries are frequently followed by *secondary ascending* and *descending degeneration.*

SYMPTOMS. The symptoms which appear after *spinal injuries* depend upon the situation and extent of the wound. As a general rule, *motor* and *sensory paraplegia*, with paralysis of the bladder and rectum, and alteration of the reflexes, are observed after transverse injuries of the cord. *Vasomotor changes*, such as pigmentation of the skin, abnormal temperature, and excessive perspiration, are frequently observed. When the injury involves the cervical or upper dorsal portion of the cord, priapism is not uncommon. Injuries involving the extreme upper portion of the cervical cord are speedily fatal. All the extremities are paralyzed, but the condition of the bladder and rectum depends upon the extent to which the lumbar portion of the cord has been involved by the shock of the injury or by secondary inflammation or degeneration. In proportion to the distance of the seat of injury from the

pper extremity of the cord will be the upper limit of sensory and motor symptoms in cases of spinal injury. When only one lateral half f the cord is wounded the symptoms of motor paralysis will be limited o the corresponding half of the body, producing *spinal hemiplegia*, if he lower extremity alone has suffered.

TREATMENT. Injuries of the spinal cord generally fall within the imits of surgery. Their medical treatment consists in the administration of mercurials and iodide of potassium; and after the subsidence of cute symptoms, galvanic currents should be applied to the spine for the pace of five minutes daily.

Spinal Hemiplegia.

ETIOLOGY. *Spinal hemiplegia* is dependent upon lesions that transersely involve one lateral half of the cord. They may be produced y fractures, dislocations, vertebral exostoses, hemorrhages, exudations, r tumors which impinge upon one side of the cord. The most characteristic examples are furnished by incised wounds of the cord, such as may be produced with knives, swords, or spears.

SYMPTOMS. *Spinal hemiplegia* is characterized by *motor paralysis* upon the side of the lesion, and *sensory paralysis* upon the opposite side of the body. If the injury be situated in the upper portion of the cervical cord, the arm and leg and muscles of the trunk upon the same side are paralyzed, while the opposite side of the body is insensible to all exterior impressions. Muscular sense alone is retained, since its fibres do not cross in the cord. Upon the injured side the sensory functions, with the exception of muscular sense, are all exalted. Corresponding to the point of injury upon the paralyzed side is a narrow band of anæsthesia that occupies the lateral half of the body, and is *anæsthetic* by reason of the direct injury of the sensory nerve roots which enter the wounded portion of the cord. Immediately above the lesion is another band that surrounds the body, and is characterized by *cutaneous hyperæsthesia*, probably occasioned by *irritation* of the *posterior nerve roots* upon both sides of the cord immediately above the seat of injury.

Vasomotor disturbances are always observed in connection with hemisection of the cord. They are especially notable after injuries that involve its cervical portion and produce paralysis of the cervical sympathetic nerve. The cutaneous vessels are dilated and filled with blood, and the temperature of the skin is elevated two or three degrees above the normal level. The ear and side of the face are red and hot, the pupil is contracted, the conjunctiva is injected, tears flow more freely, the eyeball is retracted, and the palpebral fissure is narrowed.

In severe cases *trophic disturbances* have been observed. The paralyzed muscles undergo atrophy from disease, and their electrical excitability is diminished. The *reflexes* are usually exalted; the *bladder* and *rectum* are frequently paralyzed.

CHAPTER VI.

SYSTEMATIZED DISEASES OF THE SPINAL CORD.

Progressive Locomotor Ataxia—Tabes Dorsalis.

ETIOLOGY. The disease occurs far more frequently among men than among women, and in the majority of cases it originates during the most active period of middle life. About ninety per cent. of the cases are dependent upon previous *syphilis*, though it probably bears the same relation to that disease that so many other nervous diseases sustain toward *infective diseases* generally. It sometimes results from *ergotism*, and from poisoning with various species of *lathyrus*, or with *carbon di-sulphide*, *lead* and *arsenic*. It has been observed after exposure to *severe cold*, and as a consequence of *violent exertion*, *wasting diases*, *venereal excesses*, and *injuries of the spinal column*. The disease is sometimes developed in the course of *progressive paresis*. Tabes is usually encountered among people who are exposed to excessive labor under unfavorable conditions of weather and climate. It rarely occurs in tropical countries.

PATHOLOGICAL ANATOMY. In many cases the spinal disease is only apparent on microscopical examination, but often the posterior surface of the cord appears flattened and dwindled. The *pia mater* is often turbid and thickened. The substance of the *posterior columns* is gray, and its density is increased. The *arachnoid* and *dura mater* are frequently thickened and adherent to the subjacent surface of the cord. A cross-section reveals gray discoloration of the *posterior column*, which is most conspicuous in the lower dorsal portion of the cord, but can be frequently traced upward to the medulla oblongata, or even as high as the corpora quadrigemina. The *posterior spinal nerve roots* are dwindled and gray, but their atrophy never extends outward beyond the intervertebral ganglia Similar atrophic processes may be recognized in the *cauda equina*.

The *optic nerve* undergoes degeneration from the eyeball backward as far as the corpora geniculata. Branches of the oculo-motor, trigeminal, glosso-pharyngeal, hypoglossal, and pneumogastric nerves undergo similar degenerative changes. Cerebral degeneration only occurs in cases that are associated with progressive paresis.

The *peripheral nerves* are frequently attacked by inflammation which develops at their peripheral extremities, occasioning circumscribed cutaneous anæsthesia, motor paralysis, joint diseases, visceral crises, and trophic changes in the nails and skin. A similar degeneration and atrophic conditions are observed in the *muscular nerves*.

Microscopical examination reveals *atrophy* of the *nerve elements*, and increase of connective tissue in the degenerated portions of the posterior columns. Amyloid bodies are present in great number. The walls of the bloodvessels are thickened, the lymph spaces are loaded

with minute oil globules and granular cells. The nerve fibres exhibit various degrees of atrophy and degeneration. The posterior cornua of the gray matter frequently appear shrunken, and their nervous elements (ganglion cells and fibres) are largely replaced by connective tissue. The vesicular columns of the cord exhibit atrophy of their nerve fibres, but the ganglion cells usually remain uninjured.

The degenerative process frequently extends into the *direct cerebellar tracts*, and sometimes invades the *lateral columns* or even the *anterior columns of the cord*. Occasionally the large ganglionic cells of the anterior cornua become pigmented and atrophied, producing muscular atrophy during the life of the patient.

In the lumbar region, the process of degeneration commences symmetrically in the middle portion of the posterior columns of the cord; respecting, however, a limited section immediately behind the posterior gray commissure and a small triangular space near the posterior extremity of the gray cornua. In the dorsal division of the cord the degenerative process originates in the middle portion of the funiculus cuneatus, at the point where the fibres of the posterior nerve roots pass through its substance into the gray matter of the posterior cornua. The funiculi graciles are soon invaded, and finally the entire substance of the posterior column becomes involved. In the cervical division of the cord degeneration commences in the funiculi graciles, and gradually invades the remaining portion of the posterior columns.

Symptoms. *Tabes dorsalis* is a lingering disease which gradually develops, and may persist for many years. It is not an uncommon event to meet patients who have suffered for more than a quarter of a century. Its course may be conveniently divided into three stages:

First, a *neuralgic* or *pre-ataxic stage*, in which neuralgic pains, loss of the patellar reflex, oculo-motor paralysis, pupillary changes, optic nerve atrophy, anæsthetic and paræsthetic disturbances, disorder of the functions of the bladder and rectum, and joint diseases are the most conspicuous symptoms.

Second, an *ataxic stage*, in which the phenomena of ataxia are developed in the lower extremities, and extend to the upper limbs.

Third, a *paralytic stage*, in which locomotion is no longer possible, and muscular atrophy, paralysis of the bladder, decomposition of the urine, gastric crises, progressive exhaustion, bedsores, and other consequences of wasting disease render life utterly miserable. Death frequently results from tuberculosis or from intercurrent diseases.

Pain is one of the earliest and most persistent symptoms. It frequently occupies the distribution of the sciatic nerve, and is mistaken for rheumatism or neuralgia. It occurs in paroxysms of burning, boring, or shooting pain which may continue for several hours at a time, or may assume the character of an electric shock (lightning pains). It is frequently aggravated at night and by cold weather, or other atmospheric changes. In many cases a sensation of constriction about the body is experienced, and severe gastralgia or pain in the bladder and rectum may be felt. Various forms of paræsthesia, *e. g.*, formication, prickling, burning, sensations of cold, etc., frequently add to the sufferings of the patient. *Anæsthetic spaces* sometimes are discovered

upon the surface of the skin, especially upon the thigh and perineum. At a later period the leg and foot are often involved, and *perverted sensations* are experienced in the act of walking, so that the patient feels as if his feet were placed upon feathers or upon fur. In many cases certain forms of sensibility disappear, while others are retained. Sensations may be retarded, so that perception occurs several seconds later than the cutaneous impression. Sometimes the prick of a pin is followed by double sensation, so that the first painful sensation seems to be followed after a few seconds by another still more painful impression. Sometimes a single contact, *e. g.*, pressure with the head of a pin, is perceived as if a number of simultaneous impressions had occurred in neighboring portions of the surface (polyæsthesia). The muscular sense is abolished, and the tendons, muscles, and fasciæ become anæsthetic.

As a consequence of the *loss of muscular sense*, it is impossible to stand erect with the eyes closed, or to move about in a darkened room, since the patient is unable to locate the position of his limbs, or to estimate the amount of muscular contraction that is necessary to maintain or to change his position.

The *cutaneous reflexes* exhibit little, if any, change, but the *tendinous reflexes*, especially the patellar reflex, disappear at a very early period in the course of the disease. This may be ascertained by supporting the thigh with the leg hanging freely from the knee, while the tendon below the patella is smartly tapped with a percussion-hammer, or with the border of the hand. In the majority of healthy persons this operation is followed by an active contraction of the quadriceps extensor muscles of the thigh. When it is apparently absent, it may be frequently developed while the attention of the patient is distracted, by causing him to clasp the wrist with the other hand, and to make forcible traction during the time of experiment. The patellar reflex is rarely present in tabes dorsalis, excepting those cases in which the disease chiefly involves the dorsal portion of the cord while the lumbar portion remains undegenerated, leaving intact the reflex arc for the lower extremity (ataxic paraplegia).

Vasomotor, *secretory*, and *trophic disturbances* are often absent during the whole course of the disease, but sometimes œdema and coldness of the extremities have been observed. In certain cases excessive perspiration or ptyalism may occur at intervals, and sometimes cutaneous eruptions, bedsores, pigmentation of the skin, thickening and falling of the nails, and loosening of the teeth have been witnessed. The muscles may become wasted from disease, or, if the anterior cornua become degenerated, or peripheral neuritis be established, rapid atrophy and the reaction of degeneration become apparent. In certain cases the joints, especially the large joints of the extremities, become swelled without fever or pain. The cavity of the articulation is occupied by a serous fluid which, after several weeks or months, may disappear. Sometimes the ends of the bones undergo absorption, which destroys the function of the affected joint. Frequently a certain degree of stiffness is experienced, with audible cracking of the joints during their flexion. These changes are referred to a concomitant arthritis defor-

nans. In many cases the bones are extremely brittle, and their spon-aneous fracture may occur. The arch of the foot sometimes becomes lattened and distorted, and perforating ulcers are occasionally developed ıear the metatarso-phalangeal articulation of the great toe.

Transient paralysis of the ocular muscles and of the muscles of the xtremities are often observed. In the later stages of the disease the mbs become powerless from disuse.

Subsequent to the conclusion of the first stage of the disease, *ataxia*, r *muscular incoördination*, forms one of the most conspicuous symp-oms. The gait is uncertain, the foot is brought down upon its heel, he limbs are thrown out in a swinging or jerking manner, and it is mpossible to follow a straight line along the floor. It becomes neces-ary, in consequence of the absence of muscular sense, to guide the ootsteps by the aid of the eye, and that must be reinforced after a time y a cane, then by two canes, and finally it is impossible to walk with-ut assistance. As the disease invades the upper portion of the cord, it ecomes impossible to coördinate the muscles of the upper extremity or the performance of delicate movements, such as writing, threading needle, or sewing. With his eyes shut, the patient can only with lifficulty find the end of his nose with the tip of his finger.

The functions of the bladder and rectum are frequently disordered, ometimes at an early period in the disease. In certain cases the symp-oms of spasmodic stricture make their appearance, or a continual dribbling of urine may annoy the patient. Complete paralysis and ılceration of the bladder sometimes exist, and may be followed by ammoniacal decomposition of the urine, with all its direful consequences.

Paralysis of the ocular muscles has already been mentioned. The *pupils* are frequently contracted, or they may be of unequal diameter. Frequently they cease to respond to variations of light though their power of movement in the act of accommodation be preserved (Argyll-Robertson's pupil). In many cases the sense of sight is diminished or completely destroyed. The optic papilla is atrophied and gray. The amina cribrosa is unusually distinct, and the retinal arteries are con-racted. Gradually the field of vision becomes reduced, and color-blindness may be developed.

Visceral crises are sometimes witnessed in connection with the inte-rior organs of the thorax or abdomen. They are characterized by dif-ficulty of swallowing, or by disturbances of respiration, convulsive cough, and asphyxia; by irregularity in the movements of the heart, and by paroxysms of pain that resemble angina pectoris; by severe at-tacks of vomiting and purging; by paroxysms of pain which counterfeit the symptoms of renal colic, though blood and pus are absent from the urine. These crises have been ascribed to degeneration in the course of the peripheral nerves, or of their central nuclei.

With the exception of the sense of vision the *special senses* are rarely affected. Auditory hallucinations and loss of hearing are occasionally experienced, and perversions of taste and smell have been noted.

The *intellectual functions* are seldom disturbed, though despondency must necessarily be a common experience. Occasionally the disease becomes associated with symptoms of *progressive paresis*. *Apoplecti-*

form or *epileptiform seizures* are sometimes experienced. The *sexual appetite* is often exaggerated at the commencement of the disease, but it finally undergoes complete subsidence.

DIAGNOSIS. Tabes dorsalis must not be confounded with conditions of profound *neurasthenia* in which the patellar reflex is absent. Certain cases of *diabetes mellitus* also are accompanied by symptoms that closely resemble the symptoms of tabes; and *alcoholic ataxia* is sometimes mistaken for the spinal disease, but it may be readily distinguished by reference to its cause, by the absence of ocular paralysis, by the presence of muscular tremor, and by the comparatively rapid recovery that follows judicious treatment. In many cases *diffuse syphilitic disease in the spinal cord* produces all the symptoms of tabes. *Cerebellar ataxia* is to be differentiated by the persistence of the patellar reflex, by the widely staggering gait, and by the vomiting, vertigo, occipital headache, and choked disc which indicate cerebellar disease. *Diphtheria* and other *infective diseases* are sometimes followed by ataxic symptoms and by other phenomena which closely counterfeit dorsal tabes; but in such cases pupillary symptoms are absent, the power of accommodation is lost for a time, and the history and course of the disease enlighten the diagnosis. In certain cases, however, it must be admitted that *peripheral neuritis* is accompanied by an array of symptoms that render it indistinguishable from the spinal disease.

PROGNOSIS. The prognosis is extremely unfavorable. The disease is frequently incurable before it is recognized and subjected to treatment. Periods of improvement are not uncommon, especially during the warmer seasons of the year. Partial recovery is possible, but is liable to be followed by a relapse of the disease, sometimes after a number of years.

TREATMENT. In all cases that have been preceeded by *syphilis*, the inunction of mercury and the administration of iodide of potassium should be conducted according to the method prescribed in the treatment of acute myelitis. In all cases the general treatment of myelitis should be recommended. If possible, the patient should be sent to a warm climate during the winter; and the pure air of a dry mountain retreat is advantageous during the summer. Ergot, belladonna, and similar remedies should be avoided. Nitrate of silver may be given with advantage, in doses of one-fourth of a grain, three times a day, until two drachms have been administered; beyond that point there is danger of argyrosis.

Ascending and descending galvanic currents along the spine are useful. Considerable relief from pain is derived from the faradic brush, and from the extensive use of dry cups upon the back. In certain cases of impending muscular paralysis, great benefit is sometimes obtained from the application of Junod's cupping apparatus to the extremities, by which the nutrition of the muscles is gradually improved.

Stretching of the sciatic nerve was formerly practised for the relief of tabes, but is now quite out of date. Recently suspension, by the aid of Sayre's apparatus, has been practised for the same purpose. In many cases temporary or partial improvement has been observed, but sometimes no effect, or even an injurious influence, has followed this

ethod of treatment. Suspension should be cautiously practised every her day, for half a minute at first, and its duration may be gradually creased to three minutes. This method should never be employed ith patients of a feeble constitution, or with those who suffer from car- ac or pulmonary diseases.

For the relief of pain, acetanilide or phenacetine may be administered moderate doses for many months. The patient should be cautioned ainst the use of morphine and other opiates, otherwise he will inevi- bly fall a victim to the opium habit.

Spastic Spinal Paralysis—Paralysis Spinalis Spastica.

Etiology. *Primary spastic spinal paralysis* occurs more fre- ently among men than among women, and is usually observed be- een the thirtieth and fiftieth years of life, though it is not uncommon ong children. It may be produced by exposure to cold, by injuries d over-exertion, or as a consequence of difficulty in delivery at the ne of birth.

Secondary spastic spinal paralysis occurs as a complication of other inal diseases.

Pathological Anatomy. The spinal lesion is situated in the *lateral lumns of the cord*, and consists of a *degeneration* involving the pyr- idal tracts and their connections with the ganglionic cells in the terior cornua of the gray matter.

Symptoms, Diagnosis, and Prognosis. The symptoms in uncom- icated cases take the form of *weakness*, *rigidity*, *contracture*, and *ralysis of the muscles*, associated with *exaltation* of the *tendinous flexes*, while the functions of *sensation* and of the *bladder* and *rectum* main unchanged. The cerebral nerves also remain intact.

The disease usually invades the lower extremities, and gradually ogresses upward. Occasionally it follows the opposite course, or may restricted to a single extremity, or to one side of the body.

The earliest symptom consists of *weakness* and *stiffness* of the *mus- es*. Sometimes *spasmodic movements* are witnessed. The *extensors* id *adductors* of the *thigh* gradually become contractured. The *flexor uscles* of the foot draw the extremity into the position of pes varo- uinus. It becomes difficult to raise the foot from the floor; the toes ag and strike the heel of the forward foot, so that it seems as if the tient would fall forward by reason of the entanglement of his lower mbs. Occasionally the body is jerked upward, and the foot is raised on its toes at every step (saltatory spasm). In the later stages the disease, locomotion becomes utterly impossible and the lower mbs remain excessively flexed and adducted. Similar conditions are anifested in the upper extremities and by the muscles of the body in e back.

The *electrical excitability* of the *muscles* exhibits no considerable ange. In many cases *cutaneous sensibility* undergoes paræsthetic erversions, but *vasomotor* and *trophic changes* are not developed.

The *cutaneous reflexes* exhibit little alteration, but the *tendinous eflexes* are greatly exaggerated. A tap upon the tendons or upon

the bones in any portion of the extremities is followed by excessive clonic muscular contraction. *Ankle-clonus* may be excited to an inordinate degree, but can be promptly inhibited by forcible plantar flexion of the great toe.

The disease may be protracted for an exceedingly variable period of time. In certain cases it runs its course in a few weeks, while in others it has been known to persist for more than thirty years; death occurs as a result of intercurrent diseases.

TREATMENT. The galvanic current should be applied to the spine, after the manner recommended for the treatment of tabes dorsalis. Warm baths of every description are useful, and iodide of potassium may be given internally. Suspension has been tried with some degree of success. Tenotomy and orthopædic treatment are necessary for the relief of deformities.

Acute Infantile Paralysis—Poliomyelitis Acuta Anterior Infantilis

ETIOLOGY. *Infantile paralysis* is a very common disease of childhood. It is generally observed during the eruption of the first set of teeth, and it rarely occurs after the commencement of second dentition. Nearly twice as many male as female children are attacked by the disease. It frequently follows the occurrence of infective diseases, and is often encountered among the children of neurotic families. Its sudden invasion and often tumultuous course are highly suggestive of an infective origin, which opinion is additionally reinforced by its occasional epidemic prevalence in certain localities. It is also a disease of the summer months, during which infective causes of a certain character are most prevalent.

PATHOLOGICAL ANATOMY. It occasionally happens that the symptoms of *acute poliomyelitis* exist as a result of inflammatory processes which were primarily developed in the membranes and white substance of the cord, and had extended into the gray matter of the anterior cornua; but in the vast majority of cases the disease has its primary seat in the gray matter, where it exists as an acute inflammation of the ganglionic cells in the anterior cornua. *Microscopical examination* reveals such inflammatory processes, principally in the lumbar and cervical enlargements of the cord. The number and extent of these points of inflammation is variable, and they may occupy one or both sides of the cord. The bloodvessels are dilated and distended with blood, their walls are thickened by the proliferation of their nuclei, and the usual appearances of inflammatory exudation are present in their immediate vicinity. The neuroglia undergoes proliferation, the ganglionic cells are vacuolated and otherwise distorted or destroyed. The nerve fibres to which they give origin become atrophied and disappear. In advanced cases the entire cornu becomes atrophied and shrunken by sclerotic and pigmentary degeneration. Similar processes of degeneration are sometimes discovered in the vesicular columns, and in the antero-lateral tracts of the cord, and in the anterior nerve roots; but the posterior nerve roots and the posterior cornua remain without change.

Those *peripheral nerves* that are in immediate connection with the seased portions of the cord, and *the muscles* with which they communicate, undergo degeneration. The muscular tissue becomes pale, ıe fibres dwindle and break up into their constituent fibrils, their :riation disappears, and the connective tissue is increased. Among ıe atrophied fibrils are visible others which appear hypertrophied, but ıis is probably only another form of degeneration. Not unfrequently ıe connective tissue becomes loaded with fat to an extent that masks ıe dwindling of the muscular substance; but when this event does not ccur, the degenerated muscle presents the appearance of a thin, pale and of connective tissue. The *inter-muscular nerves* also undergo imilar changes.

The process of atrophy and retarded development is not confined to ıe muscles alone, but involves *the bones and other tissues* of the ffected limb, so that it remains permanently smaller than its healthy)mpanion. Sometimes the superficial layers of fat are sufficiently eveloped to conceal, in some measure, the retarded growth of the mb.

Symptoms. The symptoms of *acute infantile paralysis* are devel-)ed in the form of a sudden and complete *flaccid paralysis*, involving rtain muscles which become rapidly *atrophied*, and exhibit *the reac-)n of degeneration*, together with *loss of cutaneous* and *tendinous flexes*, and the *absence of trophic changes* in the skin, while the *wer of sensation* and the *functions of the bladder* and *rectum* remain ıaffected. The disease frequently commences in the night, with a *gh fever*, often accompanied by *epileptiform convulsions* and other idences of cerebral disturbance. On lifting the child from his bed, it discovered that one or more of the limbs are in a condition of *flaccid ralysis*. In the course of three or four days the fever and other ute symptoms disappear. Sometimes paralysis is suddenly and cometely developed without any accompanying febrile movement, and e condition is accidentally discovered before anything unusual attracts tention to the health of the patient. Usually, however, *pain* that is *gravated by movement* attracts the notice of the mother, and the ıer symptoms are rapidly developed to an alarming extent.

Paralytic symptoms usually involve the lower extremities, but their stribution is sometimes quite irregular. The *muscles of the trunk* metimes participate in the paralysis, and in rare instances the *facial uscles* also are involved. At first all the muscles in an extremity apar to be motionless, but in the course of a few days or weeks the wer of voluntary movement is partially restored, and certain muscles over their former vigor, while other groups remain permanently ralyzed and undergo atrophy. The disease exhibits a marked tenıcy to invade groups of muscles, since the ganglionic cells in the terior cornua are connected with muscular groups, rather than with gle muscles. Thus, in the upper extremity, the deltoid, biceps, ıchialis internus, and the supinator muscles form a group which frently undergo simultaneous paralysis, while the extensor muscles of e forearm form another group that may be similarly affected. In e lower extremity the sartorius muscle generally escapes in cases of

paralysis involving the crural nerve group, while the anterior tibial muscle frequently shares in the paralysis of the quadriceps femoris muscle.

The paralyzed muscles are *flaccid*, and rapidly undergo *atrophy* with the development of the *reaction of degeneration*, after the manner that has been described in connection with facial paralysis. The paralyzed muscles are tender on pressure, and their mechanical irritability is increased. *Reflex movements* are abolished, the skin upon the affected extremity becomes cold and blue, and inordinately liable to injury from frost. As the child grows up, the affected limbs linger behind their fellows in the matter of growth, and *deformity* frequently results from the contraction of muscles which have remained healthy but are deprived of their antagonists. In the lower extremity various forms of *club-foot* are thus developed. The knees may bend too far backward. Various forms of *spinal curvature* are produced, and the shoulder-joint may undergo partial luxation from atrophy of the deltoid muscle. The elbow-joint is rarely affected, but deformities of the hand are not uncommon. The general health, however, remains excellent, and life does not appear to be shortened by the disease, though in certain instances other nervous diseases may be independently developed.

DIAGNOSIS. Acute anterior poliomyelitis must be distinguished from—

1. *Progressive muscular atrophy*, a disease which seldom attacks children and is very slowly developed.

2. *Pseudo-hypertrophy* of the muscles, a disease in which the muscles do not dwindle, and which is very slowly developed.

3. *Spastic spinal paralysis* exhibits great exaggeration of the tendinous reflexes, and is not attended by muscular atrophy, or by the reaction of degeneration.

4. *Birth-palsy* originates at the time of delivery, usually as a consequence of unusual compression of the brain. It is also associated with sensory disturbances.

5. *Myelitis*, *spinal hemorrhage*, and *compression of the cord* are accompanied by sensory and trophic disturbances, paralysis of the bladder and rectum, and the gradual appearance of other symptoms of extensive spinal inflammation.

6. *Multiple neuritis* presents evidences of sensory disturbance, while the bladder and rectum escape without injury.

PROGNOSIS. The prognosis is unfavorable, so far as the recovery of paralyzed muscles is concerned. After the first few days the life of the patient is rarely in danger. Paralytic symptoms seldom undergo any improvement after the expiration of six or eight months.

TREATMENT. During the initial fever, warm baths and antipyrine may be employed. As febrile symptoms subside, an ice bag, covered with muslin to protect the skin, should be laid against the back. Iodide of potassium may be administered in doses that correspond to the age of the child. Belladonna and ergot are recommended by some physicians. After the expiration of a week, the galvanic current may be applied to the spine with the aid of large electrodes. Alternating currents should be thus employed for two or three minutes in each direction.

A daily warm bath, in which salt has been dissolved, is of considerable service, and the paralyzed limbs should be thoroughly rubbed and gently kneaded every morning and evening. When the muscles react under the faradic current they should be moderately exercised by its aid. Electrical treatment should be discontinued at the end of six weeks, that the patient may rest for a week or two before it is again resumed. In this way, successive periods of treatment and rest should follow one another so long as improvement continues. Old cases in which the limbs have become deformed by contractures require orthopædic treatment.

Acute, Subacute, and Chronic Spinal Paralysis of Adults—Poliomyelitis Acuta, Subacuta et Chronica Anterior Adultorum.

An acute form of anterior poliomyelitis which in no respect differs from the infantile form of the disease is sometimes encountered among young adults. Its causes, course, and results apparently differ in no essential particular from those which characterize the infantile disease.

A *subacute and chronic form* is sometimes observed after middle life. It is occasionally produced by lead poisoning. It generally commences gradually, without any serious disturbance of the general health. It usually invades the lower extremities, and slowly advances upward, attacking one group of muscles after another, and sometimes finally invading the bulbar nerves and their dependent muscles.

The *paralyzed muscles* are flaccid and undergo acute atrophy, exhibiting the reaction of degeneration and other symptoms that accompany the course of infantile poliomyelitis. During convalescence the course of improvement in the condition of the muscles is the reverse of the order of their invasion. The disease in fatal cases continues from one to four years. After death the ganglionic cells in the anterior cornua of the cord are found to be atrophied and destroyed.

From *progressive spinal atrophy* the disease may be differentiated by the occurrence of paralysis involving entire muscles before their atrophy takes place.

From *amyotrophic paralysis* it may be differentiated by the absence of muscular rigidity, spasm, and exaggerated tendinous reflexes.

Multiple degenerative neuritis, with which this disease might be confounded, differs by the presence of sensory disturbances.

Spinal Progressive Muscular Atrophy—Atrophia Musculorum Progressiva Spinalis.

ETIOLOGY. *Spinal progressive muscular atrophy* is dependent upon a disseminated chronic anterior poliomyelitis. It usually commences in the upper extremities, gradually invading the muscular fasciculi one after another, and producing a progressive paralysis as the result of atrophy, without disturbance of the bladder or rectum or cutaneous sensibility. The disease is usually encountered during middle life, and is more frequently observed among men than among women, probably by reason of their greater exposure to cold and to the injurious effects of excessive exertion.

SYMPTOMS. *Progressive wasting* and *weakening* of the *muscles* mark the course of the disease. The *interosseous muscles* and the *muscles of the thenar and hypothenar prominences* are first invaded. The furrows between the metacarpal bones become strongly pronounced, and the fleshy portions of the hand exhibit a shrunken appearance. The fingers become incapable of delicate movements, and, by reason of the loss of power in the adductor and opponens pollicis muscles, the thumb can no longer be brought into accurate opposition to the fingers; it is also drawn backward by the extensor and abductor muscles, so that the hand assumes an ape-like form. At the same time the second and third phalanges of the fingers can no longer be extended, through the failure of the interosseous muscles. The proximal phalanges are drawn backward by the extensor muscles, and the fingers assume the form and position of claws.

Sometimes the atrophic process overleaps the muscles of the arm and invades the *deltoid muscle*, during the second stage of the disease. The posterior and the middle portions of the muscle are first invaded, and the process of atrophy extends from one bundle to another until the shoulder is completely flattened, and only the skin seems to cover the bones. Partial luxation of the joint takes place, and the arm hangs like a dead weight by the side.

When the *forearm* is invaded, the extensor muscles usually suffer first. The supinator muscles and the flexor muscles of the forearm fail together. The disease exhibits a tendency to invade muscles that are associated in functional groups, but finally the entire extremity is involved. In the majority of cases the disease commences upon the right side, and exhibits a tendency to attack the corresponding muscles upon the other side, as a consequence of the extension of the disease from one side of the cord to the corresponding group of cells upon the other side, before it extends in a vertical direction. After the upper extremities have been thoroughly occupied by the disease the *muscles of the shoulders, back, body, and neck* are also drawn into the course of degeneration. When the *lumbar muscles* give way, the patient leans backward so far that a line dropped from the shoulders falls behind the sacrum; but if the *abdominal muscles* are weakened, though the loins are thrown forward, a perpendicular line from the shoulders passes through the sacrum. The *lower extremities* generally exhibit atrophy in the extensor muscles of the thigh. It is less commonly observed in the hip and in the calf of the leg.

As the atrophic process works its way among the muscular fasciculi, *fibrillary contractions* become visible beneath the overlying skin. Their cause is not fully understood, but it is undoubtedly connected with the process of atrophy.

The *electrical reactions* correspond to the condition of the affected muscles. As the muscular tissue wastes it ceases to respond to electrical excitation. The *reaction of degeneration* is correspondingly displayed, first as a partial, and finally as a completely developed phenomenon. In like manner, the *cutaneous* and *tendinous reflexes* gradually disappear; but the power of *sensation* and the *functions of the*

Bladder and rectum remain unchanged; *the pupils* vary in diameter, react sluggishly to light, and gradually lose the power of dilatation.

Vasomotor and *trophic changes* are frequently observed in the skin. The *temperature* of the surface is considerably reduced. Sometimes copious *perspiration* occurs; and the *joints* may become enlarged.

The *general health* suffers comparatively little, though the long course of the disease produces the usual consequences of protracted confinement.

In certain cases the nuclei of the *bulbar nerves* are invaded, and the trophic process is manifested in the muscles of the face, tongue, pharynx, and larynx, producing the symptoms of a gradually progressive bulbar paralysis.

Death usually results from intercurrent diseases, or from gradual exhaustion, or from the consequences of bulbar paralysis, if that be developed.

PATHOLOGICAL ANATOMY. *Progressive muscular atrophy* is the direct result of a *chronic primary inflammatory atrophy* of the *ganglionic cells in the anterior cornua* of the spinal cord. In many cases the *anterior nerve roots* and the *peripheral nerves* also undergo degeneration. In the *muscles* the intermuscular connective tissue and the sarcolemma undergo a proliferation of their elements. The muscular substance becomes granular or waxy, and breaks up into fibrils or transverse segments, and gradually disappears. The degenerated muscles are either pale, or darkened by the deposit of pigment in their substance. Fatty degeneration rarely occurs, but the muscular mass undergoes a species of fibrous degeneration, analogous to that of hepatic cirrhosis.

DIAGNOSIS. Muscular atrophy must be distinguished from:

1. *Myopathic muscular atrophy*, a disease which is usually hereditary, and is encountered among young people. It usually attacks the lower extremities or the face, and is more gradually developed. Fibrillary contractions and the reaction of degeneration are generally absent.

2. *Multiple degenerative neuritis* is characterized by the development of paralysis before the occurrence of atrophy. The muscles and nerves are sensitive to pressure, and painful disturbances of sensation are present.

3. In the different forms of *poliomyelitis*, paralysis also precedes the development of atrophy and the reaction of degeneration. Sensory disturbances are absent, and the functions of the bladder and rectum are preserved.

4. *Syringomyelia* and *hydromyelia* are accompanied by anæsthesia and disturbance of the sense of temperature.

5. *Muscular atrophy that is dependent upon articular diseases* is preceded by the joint disease, and is clearly connected with it.

6. The *secondary muscular atrophy* which follows various diseases of the spinal cord can be easily distinguished by its characteristic association with the other symptoms of the spinal disorder.

PROGNOSIS. The prospect of recovery from spinal progressive muscular atrophy is very unfavorable, though the disease may persist for many years before a fatal termination is reached.

Hereditary Ataxia—Ataxia Heredi

Hereditary ataxia occurs in certain families, s
members more frequently than the male. It is
childhood, and is characterized by *ataxic movem*
involve all the extremities and the muscles of the e
which are concerned in the act of articulation. *Po*
muscles, pupillary symptoms, and amaurosis do no
bladder and rectum involved. *Sensory disturba*
and the characteristic pains of tabes dorsalis ar
patellar reflex disappears, but the patient experien
balancing himself with the eyes shut than is obser
Vasomotor and *secretory disturbances* are commonly
times *epileptic convulsions* or *mental derangemen*
cular paralysis, *contractures*, and *deformities* deve
time. After death the posterior columns of the
lateral columns, to a certain extent, are found in a
eration. The posterior columns of the cord are
while the anterior columns are but slightly invade
tinues for a lifetime, and is not amenable to treatm

Secondary Degeneration of the Spina

Allusion has already been made, in connection
compression of the spinal cord, to the fact that *sec*
may invade the spinal tracts, in an ascending or
which corresponds with the physiological functi
Diseases that involve the *trophic centres* of the diffe

corresponding crossed and direct pyramidal tracts, as far as their termination at the level of the third and fourth sacral nerve roots. The degenerated tracts may be recognized above the cord by the gray and sunken appearance of their dwindled fibres, which lie immediately underneath the surface of the pia mater. Within the cord it is necessary to resort to microscopical examination, in order to follow the course of degeneration.

The affected portion consists of nerve fibres which have undergone the ordinary changes of degenerative atrophy. The symptoms of the disease take the form of muscular contractures and exaggeration of the tendinous reflexes upon the side that corresponds to the anterior cornu which communicates with the degenerated pyramidal tract.

Ascending degeneration in the spinal cord involves the cerebellar tracts when their trophic centres in the vesicular columns are destroyed. The course of degeneration may then be traced from the level of the mid-dorsal portion of the cord, where that column originates, upward to the cerebellum. The funiculi graciles are connected with trophic cells in the ganglia upon the posterior spinal nerve roots, and when those centres are diseased or destroyed, ascending degeneration follows the path of the funiculi to the corpora restiformia. Degeneration of these ascending paths produce no symptoms that admit of recognition.

Amyotrophic Lateral Sclerosis—Sclerosis Lateralis Amyotrophica.

Amyotrophic lateral sclerosis consists of a combination of *primary degeneration* in the pyramidal tracts of the spinal cord and of the ganglionic cells in the anterior cornua, together with the nuclei of the hypoglossal, spinal accessory, pneumogastric, and facial nerves. The disease usually occurs during the most active period of middle life, and is more frequent among women than among men.

Pathological Anatomy. The disease commences in the lateral columns of the cord, and is most extensively developed in its cervical portion. It sometimes extends upward into the cerebral peduncles and corona radiata of the brain, involving the large ganglionic cells in the cortical portion of the central convolutions. From the lateral columns of the cord it extends into the anterior cornua, where it occasions proliferation of the neuroglia, with atrophy and disappearance of the ganglionic cells. In certain cases the disease commences in the gray matter and thence extends outward into the white columns.

Sometimes the posterior columns of the cord participate slightly in the morbid process. The anterior nerve roots, the peripheral nerves, and the muscles with which they are in communication, in like manner undergo atrophic degeneration. Occasionally the atrophied muscles are so loaded with fat that their volume appears undiminished.

Symptoms. *Amyotrophic lateral sclerosis* presents the symptoms of *spastic spinal paralysis*, together with those of *spinal progressive muscular atrophy* and *bulbar paralysis*. *Sensory disturbances* and functional disorders of *the bladder and rectum* are absent. Muscular paralysis, rigidity, spasm, and contracture are developed in the upper extremities and progress downward to the lower extremities. The

upon the extension of the disease into the gray matt
tractions accompany this process; the muscles are se
and exhibit the reaction of partial degeneration. S
exhibited by the muscles of the body and of the l
disease progresses, though the muscles of the inferi
hibit only that form of wasting that is dependent u
become *contractured*, and the *tendinous reflexes are*
spastic spinal paralysis.

DIAGNOSIS AND PROGNOSIS. Amyotrophic latera
differentiated from *progressive muscular atrophy*, i
follows atrophy and is developed fascicle by fascicle,
ing whole muscles at once. In progressive muscular
muscular rigidity is absent. Atrophy commences in
hand, and the atrophied muscles are painless on pres
nous reflexes disappear, and the course of the disease i
that of lateral sclerosis.

Hypertrophic cervical pachymeningitis differs by
of the symptoms of irritation at the commencement
the great disturbance of sensation which it occasion
to the cord, and by the possibility of recovery in cer

TREATMENT. The disease should be treated li
paralysis.

CHAPTER VIII.

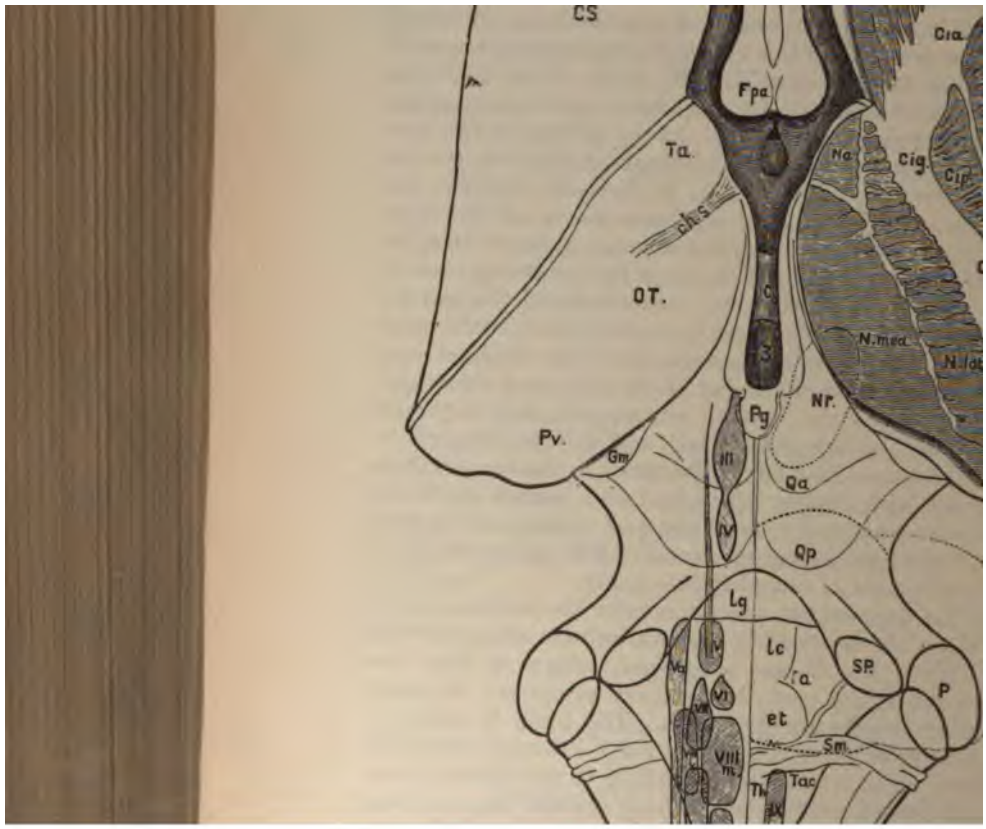
DISEASES OF THE MEDULLA OBLON

ıy be excited by any of the causes that produce spinal progres-
ıscular atrophy.

PTOMS. As a rule, *progressive bulbar paralysis* is gradually
)ed with various *disturbances of sensation* in the neck and oc-
region. After a time the *movements of the tongue* become
ed, articulation and the act of mastication are rendered increas-
ifficult. The lips and orbicularis oris muscle become atrophied
ıralyzed. Finally, the muscles of the fauces, pharynx, and
become similarly affected. The tongue lies upon the floor of
)uth, and appears wrinkled and shrunken. Fibrillary contrac-
ıre often visible in its substance. The articulation of sounds
depend upon movements of the tongue is progressively impaired.
)mes impossible to pronounce E, B, C, S, L, K, G, T, D, and
he management of food and its propulsion into the pharynx is
ed difficult, and finally impossible. As the orbicularis oris mus-
nvaded by atrophy and paralysis it becomes difficult to utter the
indicated by the letters O, U, E, A, P, F, K, M, and W. The
remains permanently open, and as a consequence of the exag-
n of the salivary secretion, there is a constant overflow of saliva
ıe corners of the mouth and over the lower lip, producing excoria-
the chin. The muscles that are connected with the *inferior*
es of the facial nerve become paralyzed, but the frontal branch
injury, so that the wrinkled appearance of the forehead con-
strongly with the passive immobility of the face and the stupid
of the mouth. As the *faucial*, *pharyngeal*, and *laryngeal*
s become invaded, speech grows nasal, and it is no longer pos-
pronounce the letters B and P. The *act of deglutition* becomes
t and attended with danger, since food and liquids are liable
to regurgitation into the naso-pharyngeal passage, or to find
ay into the larynx, producing symptoms of suffocation, or giving
n for the development of catarrhal pneumonia.

ertain cases the degenerative process invades the *external rectus*
of the eyeball, *the masticatory muscles*, and *the muscles of the*
nd head. When the disease progresses downward from the
region into the spinal cord the ordinary symptoms of *spinal*
ssive muscular atrophy are developed. The brain is never in-
and conscious intelligence remains unchanged through the whole
of the disease. The *mechanical irritability* of the diseased mus-
somewhat increased, and *the reaction of partial degeneration*
bited by the nerves and muscles under the influence of the gal-
current. *Cutaneous sensibility* remains without change. The
of the disease varies from one to three years, or more, and *death*
from the various consequences of paralysis of the different bulbar
unless some accidental and intercurrent disease should previously
ate life.

HOLOGICAL ANATOMY. The disease is restricted to the nuclei of
lbar nerves. The sympathetic ganglia and nerves remain un-
d. The large ganglionic nerve cells in the anterior cornua be-
listended with yellow granular pigment, their nuclei and proto-
c processes disappear, and finally the cells themselves break


CS
Fpa
Ta.
Cra.
Na.
Cig.
Cip.
OT.
N.med.
Nr.
Pg
Pv.
Gm
III
Qa
IV
Qp
Lg
V
lc
ra
et
SP.
P
VI
VII
VIII
m.
Sm.
Tac.
Th.

wn and are absorbed. The process consists of a primary degenera-
e atrophy, similar to what takes place in the anterior cornua during
e course of spinal progressive muscular atrophy. The fibres in the
lbar nerves also undergo similar degenerative atrophy. The accom-
nying diagram readily explains the progressive invasion of the bulbar
clei, and the grouping of the consecutive symptoms. (Fig. 158.) In
e muscular tissue of the atrophied muscles, wasting and disappearance
the contractile tissue and proliferation of the interstitial connective
sue may be readily discovered. The progressive invasion of the
uscle, fibre by fibre, is also apparent, as it is in spinal cases; and
metimes the accumulation of fat in the connective tissue is sufficient
conceal the evidences of reduction in the volume of the muscular
res. In certain cases the evidences of muscular degeneration are
ly apparent under the microscope, so that this method of investigation
ould never be omitted.

DIAGNOSIS. 1. The *differential diagnosis of bulbar paralysis* requires
ention to the fact that the symptoms of bulbar paralysis may be de-
loped without any accompanying changes in the central nervous
stem (pseudo-bulbar paralysis). This disorder is usually attended
th symptoms of fever.

2. *Hemorrhages, thrombosis, and embolism of the medulla oblongata*
y occasion symptoms of bulbar paralysis; but they are developed
ddenly, and are associated with sensory disturbances and other evi-
nces of paralysis, unaccompanied by wasting of the muscles and
nge in the electrical reactions.

3. *Compression of the medulla oblongata and the bulbar nerves* by
nors and aneurisms sometimes produces paralytic symptoms which
o involve the auditory and trigeminal nerves; but the other symptoms
pressure are also exhibited in the form of convulsions, vomiting,
tigo, choked-disc, and loss of vision.

4. *Hemorrhage involving both hemispheres of the cerebellum* might be
lowed by bulbar symptoms; but in such cases the muscles do not
come atrophied, since their trophic centres remain unharmed, and the
ctrical reactions are unchanged. Respiratory and laryngeal dis-
lers are also absent.

5. *Multiple cerebro-spinal sclerosis* has been observed with associated
mptoms of bulbar paralysis; but in such cases other symptoms of
rebral and spinal disease are apparent.

6. *Congenital bulbar paralysis*, which has been observed among
ung children, recovers either spontaneously, or under the influence of
ctrical treatment.

PROGNOSIS. The prognosis in cases of well-marked progressive bul-
r paralysis is quite hopeless, though improvement is sometimes
served in cases of syphilitic origin.

TREATMENT. In many cases it becomes necessary to make use of
uid food, and to resort to the use of the œsophageal sound for its
ministration. Excessive salivation may be relieved by the use of
ropine. At the commencement of the disease counter-irritation
ould be applied to the back of the neck, and the bowels should be
ntly opened. Iodide of potassium should be administered internally,

and in syphilitic cases the inunction of mercurial ointment must be practised. Salt-water baths are beneficial, but cold baths should be avoided. Very little benefit can be expected from ordinary nervine remedies; but the galvanic and faradic currents may be employed with benefit. In the last stages of the disease the symptoms of asphyxia may render it necessary to perform tracheotomy.

Progressive Nuclear Ophthalmoplegia—Ophthalmoplegia Progressiva Nuclearis.

This disease consists of a *paralysis of the external ocular muscles*. In typical cases the muscles of accommodation and of pupillary reaction to light remain unchanged. In certain cases the disorder is associated with progressive bulbar paralysis, with progressive muscular atrophy, or with tabes dorsalis. The duration of the disease is exceedingly variable, and in acute cases may result in recovery. The symptoms are the consequence of *degenerative atrophy of the nuclear cells* in which the oculo-motor, trochlear, and adducent nerves originate, along the floor of the third ventricle and aqueduct of Sylvius. Under such circumstances the disease is developed gradually, but when the paralytic symptoms result from thrombosis, or embolism, or hemorrhage, obstructing the circulation of blood in the nuclei, the symptoms are developed suddenly. *A functional form of ophthalmoplegia* is sometimes observed which corresponds to the analogous functional variety of bulbar paralysis.

Progressive ophthalmoplegia is sometimes congenital, but it may be the consequence of injuries, syphilis, or other infective diseases, lead poisoning, chronic alcoholism, and diabetes. Treatment with iodide of potassium affords the best results, and is sometimes followed by recovery.

Bulbar Hemorrhage—Hæmorrhagia Medullæ Oblongatæ.

Hemorrhages that are limited to the medulla oblongata are exceedingly rare. They produce changes similar to those which are observed in cases of analogous hemorrhage into the spinal cord; and they are the result of the rupture of miliary aneurisms in the arterial vessels. Death speedily results in the majority of cases, preceded by the symptoms of severe apoplectic or epileptiform seizure. The pulse becomes irregular and inordinately frequent, and the temperature is excessively elevated. Paralytic symptoms may involve one or all four of the extremities, and may be direct or crossed, according to the position and extent of the hemorrhage. Symptoms of irritation of the cerebral nerves at a distance from the seat of hemorrhage may be associated with symptoms of bulbar paralysis extending also to the extremities. A fatal result is almost inevitable, and the treatment is that which will be described in connection with the subject of cerebral hemorrhage.

Embolism and Thrombosis of the Bulbar Arteries.

Thrombosis in the region of the medulla oblongata is generally dependent upon syphilitic endarteritis; while *embolism* is usually asso-

ciated with disease upon the left side of the heart. Vascular obstruction thus caused produces softening of the tissues in the obstructed territory, and leads to the development of symptoms which resemble an acute or apoplectiform bulbar paralysis. *Death* may occur suddenly, or the symptoms of an apoplectiform or epileptiform seizure may be exhibited; though in cases of circumscribed capillary obstruction, the signs of disorder may be limited to vertigo and vomiting, which may be followed, however, by progressive weakness and ultimate paralysis. *Paralytic symptoms* may involve the extremities alone, or the bulbar nerves, or both may be simultaneously affected. The character and extent of the paralytic phenomena obviously depend upon the position and extent of the obstruction in the course of the circulation. Gradual recovery may result from the establishment of new paths for the circulation; or secondary degeneration may extend into the pyramidal tracts of the spinal cord, producing contractures and exaggeration of the tendinous reflexes in the extremities, a condition that differs from amyotrophic lateral sclerosis only in its sudden origin and in the absence of subsequent muscular atrophy. Obviously the location of the disease occasions great danger to life.

Acute Inflammation of the Medulla Oblongata—Myelitis Bulbi Rachitici Acuta.

This rare disease is marked by the occurrence of red inflammatory softening in disseminated foci irregularly distributed through the substance of the medulla oblongata, producing symptoms of acute apoplectiform bulbar paralysis, with or without paralysis of the extremities, and causing death, preceded by symptoms of asphyxia, in the course of from four to ten days. The existence of the disease may be suspected when the symptoms of acute bulbar paralysis are developed with moderate fever, and without evidences of hemorrhage, embolism, or compression of the medulla.

Bulbar Tumors—Neoplasmata Medullæ Oblongatæ.

Tumors involving the medulla oblongata are usually of a tubercular character, but all the other varieties of neoplasm have been observed. They produce general symptoms which are dependent upon increase of pressure within the cavity of the cranium, viz.: vomiting, vertigo, choked disc, loss of vision, and epileptiform convulsions. The local symptoms consist at first of the evidences of irritation of the bulbar nerves, which condition is finally succeeded by their paralysis. The consequent nervous disorders develop in the form of strabismus dependent upon paralysis of the sixth nerve, together with paralysis of the muscles of the face, tongue, fauces, pharynx, and larynx, with which are associated disorders of hearing, respiration, and circulation. Obstinate hiccough, sensory, and motor paralysis in the extremities and body, polyuria, and saccharine diabetes have also been observed. Sometimes conjugated deviation of the eyes, and lateral rotation of the head, are produced in consequence of interruption of the tegmentary fibres

that connect the corpora quadrigemina and the rotator muscles of the head with each other. It is often impossible accurately to diagnosticate the disease, since tumors in the neighborhood may produce compression of the medulla oblongata. *Progressive bulbar paralysis* may be differentiated by the absence of general cerebral symptoms. The prospect of recovery is exceedingly unfavorable, except, perhaps, in cases of syphilitic origin.

Injuries and Compression of the Medulla Oblongata.

Injuries of the medulla oblongata usually produce immediate death. In certain cases compression may be suddenly produced by fractures, or by dislocation of the upper cervical vertebræ. Tubercular diseases of the bones or tissues in the neighborhood may develop gradual compression of the bulb; and similar results follow the growth of tumors or the occurrence of arthritis deformans in the upper cervical articulations. The symptoms take, at first, the character of *irritation* of the bulbar nerves, which is finally merged in the phenomena of *paralysis*. These symptoms admit of easy recognition, but their precise cause is not always apparent before death and autopsy.

PART XII.

EASES OF THE SYMPATHETIC NERVES AND OF THE MUSCLES.

CHAPTER I.

DISEASES OF THE SYMPATHETIC NERVES.

itation of the cervical sympathetic nerve in the neck is indicated
atation of the pupils, unusual width of the palpebral fissure, and
ision of the eyeball consequent upon excitement of the nerve fibres
re distributed to the dilator muscle of the pupil and to the muscle
iller. *Vasomotor disturbances* also exist, and are indicated by
odic constriction of the arteries, producing pallor and coolness
the corresponding side of the face. Sometimes *trophic changes*
dicated by a shrinkage of the tissues in the affected portion. In
n cases the cervical ganglia appear sensitive to pressure.
itation of the sympathetic nerve in the neck is usually produced
uries, or tumors that involve the spinal cord, the cervical vertebræ,
tissues in the neck.

ralytic conditions of the cervical sympathetic nerve are indicated
ralysis of Müller's muscle and of the dilator muscles of the iris;
quently the pupil is contracted, reacts sluggishly to light, and
e oval instead of round in form. The eyeball sinks backward,
ne width of the palpebral fissure is diminished. The arteries that
y the blood to the head and face are dilated and distended, causing
rease of color and heat. *The secretion of tears, saliva, and per-
ion* is augmented; and *the temperature* is sometimes elevated.
ic changes may be developed after a time.
ralysis of the sympathetic nerve may be produced by the same
s that are efficient in the production of irritative conditions in the
. Usually the symptoms of irritation are followed by those of
sis, and frequently the two different states alternate with each

e *treatment* of irritation and paralysis of the sympathetic nerve
ds upon their causes. The galvanic current may be used with
advantage. When it is desirable to quiet irritation, the anode
l be placed over the sympathetic ganglion in the side of the neck

below the angle of the jaw, while the cathode is placed upon an indifferent portion of the body. In paralytic conditions the position of the electrodes should be reversed.

Hemicrania.

ETIOLOGY. *Hemicrania* (migraine) is usually experienced by females during the period of youth and middle life. The disease is frequently of an hereditary character, or it may be developed as a consequence of exhaustion after over-exertion or debilitating diseases. It is often associated with hysteria, gout, and rheumatism, and it may recur during pregnancy or as a symptom of latent renal disease and uræmia. Disorders of digestion, constipation, and menstruation are frequent excitants of the disease. It has also been ascribed to various reflex causes involving the nasal and pharyngeal passages.

SYMPTOMS. *An attack of hemicrania* sometimes commences suddenly, but it is often preceded by sensations of vague discomfort and disturbance of the cerebral functions. In certain cases the patient awakens with headache, but it often comes on during the forenoon and only ceases after the occurrence of sleep during the following night. The paroxysm rarely continues more than one day. The character of the pain is usually dull and heavy. Sometimes it is increased by every pulsation of the heart. It is more severe upon one side of the head than upon the other, and it is often circumscribed within still narrower limits. The occipital region generally escapes, while the forehead and vicinity of the eye is the favorite seat of suffering. Pressure-points do not exist, but frequently the skin is excessively sensitive to slight pressure or to contact with the hair, though deep pressure usually gives a certain amount of relief. Light and sound become intolerable, nausea and vomiting are not uncommon, and sometimes the bowels and kidneys are considerably relaxed.

Two forms of the disease have been described. They differ principally through opposite conditions of the cervical sympathetic nerve. *Spastic hemicrania* is associated with the symptoms of irritation involving the cervical portion of the sympathetic nerve, producing contraction of the bloodvessels, while *paralytic hemicrania* is accompanied by the symptoms of its temporary paralysis, indicated by vascular relaxation. In many cases the symptoms of irritation attend the commencement of the attack, and after a time give way to the evidences of paralysis.

Hemicrania is frequently a lifelong disease; but among women it often ceases at the menopause, and under all circumstances the paroxysms usually become less severe and less frequent at an advanced age.

TREATMENT. Though it is often impossible to effect a complete removal of the disease, its severity may be diminished by general treatment that is calculated to improve the health and to remove those causes of a depressing nature by which the nervous system is predisposed to disease. Each case affords a large opportunity for experiment with restorative remedies, and the effects of change of air cannot always be foreseen. Some patients are benefited by residence at the seaside, while others are much more favorably affected by mountain air. The greatest

is often derived from gentle stimulation of the bowels and kid-
Electricity is often useful, and may be employed according to
les for the treatment of sympathetic irritation and paralysis.
the paroxysm the patient finds relief in the recumbent position
rk and quiet room. When symptoms of indigestion are promi-
blue pill, followed by a Seidlitz powder, or the action of an emetic,
ive relief. When cerebral symptoms take the lead the headache
ıtly is relieved by large doses of salicylic acid, acetanilide, or
etine. When paralysis of the sympathetic nerve exists, caffeine,
a, strychnine, and quinine are useful. A combination of caffeine
bromides often gives great relief, but sometimes it is necessary
inister a full dose of laudanum. Opiates should be prescribed
he greatest caution, for fear of establishing the opium habit.
ent relief is frequently obtained from the application of mustard
back of the neck, or other stimulants, like veratrine, menthol, or
of peppermint, to the forehead and temples.

ssive Facial Hemiatrophy—Hemiatrophia Facialis Progressiva.

)LOGY. For this rare disease no uniform cause is known,
it has been observed after injuries, after infective diseases, and
posure to cold. (Fig. 159.)

FIG. 159.



Facial hemiatrophy. (RUSH MEDICAL COLLEGE CLINIC.)

PTOMS. *Facial hemiatrophy* is characterized by progressive
of the skin, subcutaneous tissues, muscles, bones, gums, and
upon one side of the face. The disease develops gradually with
perversions of sensation in the affected part. The hair becomes
d sometimes changes color. Brownish spots appear upon the
d gradually extend, becoming more or less confluent. The sub-
fat disappears, the skin grows thin and is depressed, forming
rrows that correspond with the outlines of the discolored patch.

The eye upon the affected side appears sunken, and the corner of the mouth is sometimes slightly drawn open by the contracted tissues. The nostril may be also similarly deformed, so that the face appears twisted toward the affected side. *Sensation*, *temperature*, and *perspiration* are not affected, but the function of the *sebaceous glands* is usually diminished. The *bloodvessels* exhibit nothing abnormal, and the circulation of blood experiences no change In severe cases the *muscles* and *bones* upon the affected side participate in the atrophic process. The *cartilages* of the nose and ear are also involved in a similar manner and sometimes the corresponding half of *the tongue* and of the *fauces* exhibit the same changes. The *muscular fibres* are reduced in size, but their *electrical reactions* are usually unchanged. Sometimes the *sense of taste* is somewhat reduced upon the affected side, but the other special senses seldom suffer. Symptoms of irritation in the territory of the *cervical sympathetic nerves* are occasionally witnessed, and in rare instances both sides of the face undergo atrophy. The disease is exceedingly chronic, but is not attended with danger to life.

In a few instances **hemifacial hypertrophy** has been observed. It is a congenital condition involving the soft parts of the face, ear, tonsils, and tongue. The skin is darkly discolored, the sebaceous follicles are enlarged, and the hair grows more abundantly than upon the healthy side. The deformity frequently involves the other structures upon the same side of the body.

Acromegaly—Akromegalia.

Acromegaly is characterized by an inordinate and morbid growth of the extremities and under jaw. It is a rare disease, and nothing is known regarding its causes. It is usually developed after the age of puberty, and is often preceded by vague symptoms of headache, and other forms of pain in the extremities. Gradually the hands and feet grow larger and more clumsy. An expression of distress is developed upon the countenance, indicating the state of depression into which the patient is brought. The skin and the muscles do not share in the process, but the nails become incurved or unusually flattened and brittle. The patellæ share in the osseous enlargement, and the legs resemble those of patients afflicted with elephantiasis. The thighs and the upper arms are but slightly changed. The lower jaw becomes unusually large and prominent, though the teeth remain unchanged. The lower lip is thickened, and the nose is greatly enlarged. The eyebrows become unusually prominent, and the eyelids are thickened. Sometimes the ears also become enlarged and pointed. In certain cases the bones of the thorax, the collar bone, and the shoulder-blade share in the general deformity. The head bends forward and seems to sink between the enormous shoulders until the chin rests upon the sternum. The internal organs sometimes are enlarged. The thyroid gland is frequently atrophied, though the thymus gland is occasionally enlarged. Cutaneous sensibility and the electrical reactions of the nerves and muscles remain unchanged. The sexual functions cease, but the other appetites

are often exaggerated, and the mind exhibits evidences of progressive weakness.

The disease is often very rapidly developed, and its duration is protracted for many years. Death usually results from intercurrent diseases or from exhaustion. Aside from the changes which have been already described nothing has been discovered to account for the disease. The sympathetic ganglia have been found in a state of enlargement, and the hypophysis cerebri is almost always enlarged; but since nothing is known regarding the functions of this organ the fact throws no light upon the pathology.

The diagnosis of acromegaly is usually easy, since the inflammatory diseases by which the extremities are sometimes deformed (*osteitis deformans* and *arthritis deformans*) are accompanied by pain and other evidences of acute disease in the joints and bones. *Elephantiasis* and *myxœdema* can be differentiated by the fact that the bones do not participate in the deformity which they produce. *Leontiasis ossea* involves the bones of the cranium alone.

Myxœdema.

Myxœdema is characterized by three cardinal symptoms: solid œdema, cachexia, and nervous derangement.

The *features* become universally disfigured by an œdematous swelling which also involves the extremities and the body, and invades the mucous surfaces. The *skin* is pale, cool, and waxy, and does not pit on pressure, since it and the subcutaneous tissues are infiltrated with mucin. Sometimes the surface appears livid, and the general *temperature* of the body is considerably depressed. The *pulse* is retarded, the *appetite* disappears, the *bowels* become constipated, the *urine* is albuminous, *blood is extravasated into the retina* and other tissues. The *voice* becomes rough and otherwise unnatural, the patient sinks into a state of exhaustion, apathy, and somnolence, sometimes accompanied by delirium and other evidences of mental disturbance.

The disease is chronic and often continues for many years. Endarteritis and other morbid changes have been observed in other organs of the body, but the nervous system usually exhibits no signs of disease. A similar condition has been experimentally produced in monkeys by extirpation of the thyroid gland; and it has been also observed after operation necessitated by thyroid enlargement in the human subject.

Good diet and general symptomatic treatment, together with massage and electricity, afford the most favorable results. Pilocarpine has been recommended to stimulate the functions of the skin when they are deficient and albuminuria is present.

Erythromelalgia.

Erythromelalgia is a vasomotor neurosis involving the extremities, and corresponding to the analogous spastic and paralytic conditions that are dependent upon irritation and paralysis of the cervical portion

of the sympathetic nerve. *The spastic form* of the disease is most frequently observed among women, especially among washerwomen who are compelled to keep their hands for a long time immersed in cold water. It is characterized by burning and painful sensations, commencing in the fingers and toes and extending up the limbs. The volume of the pulse is diminished, the skin becomes cold and pale, or cyanosed, and is sometimes covered with clammy perspiration. Sometimes the extremities appear somewhat swelled and stiffened, and the skin loses a portion of its sensitiveness to external impressions. The paroxysms occur more frequently during cold weather, at which time they are sometimes numerous and prolonged, and may be easily excited by exposure.

The paralytic form of erythromelalgia is usually experienced by men during middle life. It is sometimes preceded by rheumatism or by exposure to cold and unusual fatigue. It has been sometimes observed among artisans who were employed in the working of copper. The disease is manifested in paroxysms of severe pain in the extremities. Sometimes there is no change of color, but usually the skin becomes flushed and warm over the affected portion. Hot weather and exposure to heat cause an increase of suffering, so that the patient usually lies with his feet uncovered at night. Unlike the spastic form, the paralytic variety usually attacks the feet rather than the upper extremities.

The *treatment* requires attention to the general health, together with a careful search for special causes of nervous irritation or exhaustion. Electrical treatment affords the best results. Local applications, anodyne liniments, etc., only yield temporary relief.

Intermittent Articular Dropsy.

Intermittent swelling of the joints, most frequently observed in the knee-joint, has been occasionally described. The cavity of the joint remains distended for about a week without the existence of any inflammatory symptom or pain. Swelling then subsides, and after an intermission of a week or longer, it is again renewed. In this way the disease may be prolonged for many months or years. Nothing is known regarding its causes. It has been treated with anti-periodics, ergot, and electricity.

Intermittent Angioneurotic Œdema.

This disease is sometimes hereditary, and it is more frequently observed among neurotic patients of the male sex than among females. It is sometimes associated with menstruation and the menopause, and it is not uncommonly caused by exposure to cold or by rheumatism and alcoholism. It is characterized by disordered conditions of the alimentary canal and by the paroxysmal occurrence of circumscribed patches of œdema upon the surface of the skin and mucous membranes. Sometimes the affected parts exhibit no change of color, but they may be either unusually pale or flushed. The disease most frequently involves the neighborhood of the joints upon the extremities, but it sometimes appears upon the face or occasions swelling of the joints themselves.

The paroxysm seldom lasts more than a few hours, but it may be often repeated during many months or years. In certain cases it occasions the symptoms of acute œdema of the glottis, necessitating scarification of the parts. Ordinary cases are relieved by attention to the condition of the digestive organs and kidneys.

Symmetrical Gangrene.

Symmetrical gangrene (Raynaud's disease) is usually observed among anæmic, enfeebled, and nervous women. It may be excited by the ordinary causes of nervous disease. It sometimes follows influenza and the infective diseases, and may be attended by swelling of the spleen as if it were itself produced by an infective cause. In certain cases it is dependent upon peripheral neuritis or upon other diseases involving the brain and spinal cord.

The fingers and toes are the usual seat of the disease, but it sometimes attacks the tip of the nose or the rims of the ears. Less frequently does it occur elsewhere. The skin becomes pale, cold, and cyanotic. Sometimes the pulse can be no longer felt. The epithelium becomes blistered and elevated by bullous eruptions that are soon followed by the development of gangrene. The symmetrical character of the process is worthy of remark. In many cases the fingers and toes are destroyed, and patches of superficial gangrene sometimes develop elsewhere. The process is often accompanied by high fever and other symptoms of violent inflammation, but usually life is preserved and recovery commences in the course of two or three weeks.

Symmetrical gangrene has been ascribed to the existence of vascular spasm and consecutive local asphyxia, but it is probably dependent in many cases upon other diseases. In certain instances a peripheral neuritis, or an inflammation of the arteries and veins has been discovered.

The *treatment* must be largely symptomatic and surgical. During convalescence tonics and restoratives should be prescribed.

CHAPTER II.

DISEASES OF THE MUSCLES.

Pseudo-muscular Hypertrophy—Pseudo-Hypertrophia Musculorum.

ETIOLOGY. *Pseudo-muscular hypertrophy* is usually observed before the fifteenth year. It is more frequent among males than among females. It is often dependent upon hereditary causes. It is more commonly transmitted by the mother than by the father, because male patients are seldom capable of contracting matrimony, while the disease may be inherited through the maternal parent, who remains herself unaffected, and consequently capable of contracting marriage. The disease sometimes follows the *infective diseases*, and it has been encoun-

tered among juvenile victims of *alcoholism*. It is frequently excited by *injuries*, or by *exposure to wet and cold;* and it is often associated with *idiocy* and other evidences of *defect or disease in the nervous system*.

SYMPTOMS. *Pseudo-muscular hypertrophy* is chiefly characterized by the increase in size of certain muscles which, at the same time, diminish contractile power, while other muscles simultaneously undergo atrophy and progressive weakness. The disease is sometimes congenital, but under other circumstances it gradually develops. Muscular exercise is attended with fatigue and some degree of pain. Such children cannot walk until they are four or five years of age, and they move with an uncertain gait. Gradually the muscles in the calf of the leg become conspicuous by their size, then follow the extensor muscles of the thigh and the gluteal muscles. As these changes progress the muscles of the back and of the upper extremity become atrophied, so that with the lower limbs of an athlete are associated the body and upper extremities of a starveling. Occasionally the upper part of the body, the face, and the tongue participate in the hypertrophic process.

The power of locomotion fails as the process advances. The toes are liable to drag, the gait is waddling, the lumbar vertebræ are thrown forward, while the upper dorsal vertebræ project backward. It becomes difficult to sit down, since the body tends to fall helplessly upon its seat; and when the patient is placed upon the floor he can only get up through great exertion, supporting the body by placing the hands first upon the knees and then slipping them one after the other up the thighs as he rises from the floor, thus literally climbing up his own lower extremities.

Muscular contractures are sometimes developed in the lower limbs, and the foot may assume the varo-equinus position. *Fibrillary contractions* and the *reaction of degeneration* are not observed. The *electrical excitability* of the muscles diminishes as they dwindle. The muscular mass becomes enlarged, firm, and hard as a consequence of the proliferation of its connective tissues. When fat is abundantly deposited in that tissue, it imparts a tallowy sensation to the hand by which it is compressed. Sometimes the muscles are *sensitive* to pressure, and the *mechanical excitability* very gradually disappears. The skin over the affected muscles becomes blue and cold, but its sensibility remains unchanged. There is diminution of perspiration, and inflammation is easily excited upon the surface in consequence of *trophic and secretory disorder*. The subcutaneous connective tissue frequently becomes loaded with fat, and the patellar reflex finally disappears. The general health is long preserved. Sometimes idiocy and imbecility exist. Pulmonary and cardiac diseases are easily excited, and are not uncommon causes of death. The bowels are evacuated with difficulty by reason of muscular weakness, but the bladder undergoes no disturbance of function.

The duration of the disease is chronic, in many cases lasting for more than twenty years.

PATHOLOGICAL ANATOMY. The *brain*, *spinal cord*, and *sympathetic nerves* exhibit no morbid changes. Such interstitial degeneration as

may be sometimes discovered in the peripheral nerves is only an accidental consequence of disuse. The *muscular tissues* appear yellow, and sometimes can scarcely be differentiated from adjacent masses of fat. The disease involves the muscular fibres, which gradually dwindle and undergo fatty or other forms of degeneration, and are replaced by interstitial connective tissue which, in its turn, undergoes extensive infiltration with fat.

DIAGNOSIS. Pseudo-muscular hypertrophy can be readily differentiated from *spinal progressive atrophy* by reference to the origin and course of that disease, and by the apparent enlargement of the muscles. *Acute anterior poliomyelitis* commences suddenly, and the paralyzed muscles exhibit the reaction of degeneration. *Myelitic paralysis*, accompanied by accumulation of fat, presents a much higher degree of paralysis, and it is developed more rapidly before the muscles become overladen with fat.

PROGNOSIS AND TREATMENT. The disease, though not immediately dangerous to life, is probably never healed. Its course may be retarded by massage and by the application of electricity to the affected muscles. Internal remedies produce no appreciable effect. In many cases orthopædic assistance will be found necessary.

Juvenile Progressive Muscular Atrophy—Atrophia Musculorum Progressiva Juvenilis.

ETIOLOGY. *Myopathic atrophy* tends to assume a variety of forms invading sometimes this, sometimes that group of muscles. The juvenile form above indicated is characterized by muscular weakness, due to atrophy of the muscular fibres, caused by increase of the interstitial connective tissue. This, in some cases, is sufficient to produce apparent enlargement of certain muscles, though without the accumulation of fat which characterizes pseudo-muscular hypertrophy. The disease is largely dependent upon hereditary influences, and it is developed during childhood or early youth, among females as well as among the opposite sex.

SYMPTOMS AND DIAGNOSIS The most characteristic symptom of the disease consists in the parallel extension of *muscular atrophy* with apparent *muscular hypertrophy*. The *atrophic process* commences in the back, shoulder, upper arm, and supinator longus. The lower portion of the body, the thigh, and the tibialis anticus muscle are affected at a later period. The muscles of the forearm, hand, and calf of the leg escape entirely, or are involved at a late period only, and furnish a striking contrast to the atrophied muscles nearer the body. The following muscles usually escape disease: The *muscles of the face and of mastication, the sterno-cleido-mastoid, levator anguli scapulæ, teres major, teres minor, supra- and infra-spinatus, coraco-brachialis,* and *deltoid;* that is, the group of muscles by which the arm is raised and rotated at the shoulder. In the lower extremity the *sartorius* muscle and the *muscles* in the *calf of the leg* also escape. These groups undergo *hypertrophy*, and stand out under the skin with a prominence that is doubly conspicuous by reason of the atrophy that has invaded their fellows. The *mechanical* and *electrical excitability* of the muscles, the

tendinous reflexes, and the condition of the *sphincters* correspond with what has already been described in pseudo-muscular hypertrophy. *Sensory disorders* and *fibrillary contractions* do not occur. The course of the disease is coextensive with life, and death results after many years from exhaustion or from intercurrent diseases.

PATHOLOGICAL ANATOMY. The principal changes are observed in the muscular fibres. They become hypertrophied, vacuolated, and finally atrophied, while the connective tissue is only moderately increased, and fatty infiltration does not occur.

TREATMENT. Medication is useless, and the only treatment that is of any service consists of massage and the use of electricity.

Another form of **juvenile progressive myopathic atrophy** has been described, in which the hereditary influences and the general course of the disease are identical with the preceding forms, but the muscles of the face participate in the process, giving a peculiar expression to the countenance and interfering with the movements of the eyelids and lips. The muscles of mastication, together with the muscles of the tongue, fauces, and larynx, remain unchanged. The majority of the muscles in the back and in the extremities are also involved, with the exception of the sub-scapular, supra- and infra-spinatus muscles, and the flexors of the hand and fingers. Hypertrophy of muscular fibres and the accumulation of fat do not take place. The muscular fibres undergo simple atrophy, accompanied by very moderate proliferation of the connective tissue. The spinal cord and the peripheral nerves remain perfectly healthy.

In certain rare cases the **voluntary muscles** undergo **true hypertrophy**, without any of the accompanying changes that characterize pseudo-muscular hypertrophy. The process is gradually developed, and is accompanied by a certain amount of neuralgic pain and other perversions of sensation. The vigor of the affected tissues is diminished, and sometimes idiocy is manifested. The prognosis is grave, since the patient becomes more and more enfeebled. The same management is required as in pseudo-muscular hypertrophy.

Progressive Muscular Ossification—Myositis Ossificans Progressiva.

This rare disease usually commences during childhood, and its causes are unknown. It is a very chronic disorder, continuing for many years. It is characterized by symptoms of pain and inflammation, usually commencing in the muscles of the back, neck, and shoulders, whence it may extend to many of the muscles of the face and extremities. As the disease progresses the muscles appear to be invaded by a tumefied mass which, after a time, may disappear, but which sometimes occasions induration and contraction of the muscles, and finally results in its ossification. Sometimes the newly formed osseous mass becomes adherent to the subjacent bones, which in their turn frequently develop multiple exostoses. The effect of these changes is marked by very notable deformity and loss of function in the invaded muscles. The limbs consequently become stiffened, and locomotion is seriously im-

peded. Occasionally ossified masses undergo degeneration and are reabsorbed.

TREATMENT. The ordinary treatment of local inflammation is indicated at the commencement of the disease. As the acute symptoms subside iodide of potassium should be administered internally, together with daily warm baths and cautious manipulation of the affected muscles, which may also be rubbed with mercurial or iodoform ointment. Various alteratives may be prescribed as required.

Acute Multiple Muscular Inflammation—Polymyositis Acuta.

Nothing is known regarding the causes of this disease. It begins with fever and pain involving the back and limbs, sometimes associated with rheumatic swelling of the joints, but chiefly affecting the muscles of the body and extremities. They become swelled, tense, and painful on pressure. The overlying skin is tense and œdematous. The tendinous reflexes are abolished in the affected parts, but the electrical excitability of the muscles remains without change, and the nerve trunks are not sensitive to pressure. As the disease improves in one muscle, it is liable to grow worse in another. *Death* may occur as a consequence of invasion of the respiratory muscles. *Microscopical examination* reveals the symptoms of inflammation in the interstitial tissue, with waxy or fatty degeneration of the muscular fibres. The nervous system remains unchanged.

The disease differs from *polyneuritis* in the fact that the nerve trunks are not sensitive to pressure, and that the electrical excitability of the muscles is preserved. In many respects the disease resembles *trichinosis*, but it may be distinguished by the absence of the parasite. The *prognosis* is not favorable. During the early stage of the disease the ordinary methods of antiphlogistic treatment are required, together with the use of salicylic acid. After the subsidence of acute symptoms gentle massage and faradization will be found useful.



PART XIII.

ISEASES OF THE BRAIN AND CEREBRAL MEMBRANES.

CHAPTER I.

DISEASES OF THE CEREBRAL MEMBRANES.

rombosis and Inflammation of the Cerebral Sinuses—Thrombosis et Phlebitis Sinuum Duræ Matris Cerebri.

ETIOLOGY. *Thrombosis* frequently exists as a consequence of in-mation of the cerebral sinuses, but it may also arise in the course chronic, wasting, or malignant diseases. In such cases the disease ally involves the superior longitudinal sinus or the transverse sinus. Occasionally thrombosis is caused by direct pressure upon the sinuses, by compression of the veins in the neck, or as a consequence of ob-uction to the return of blood into the thoracic vessels. Inflammatory tubercular processes within the cranium, and the existence of uries, wounds, or infective diseases involving the scalp and the face, frequently followed by the formation of thrombi in the sinuses of brain.

PATHOLOGICAL ANATOMY. In *thrombosis of the sinuses* their cavity occupied by an imperfectly organized coagulum, of a brown or gray or, which differs widely from the simple blood clots that are frequently covered in the sinuses after death. The partially organized structure somewhat adherent to the vascular walls, and it frequently extends the veins that communicate with the cavity in which it has its gin. The obstructed veins are obviously distended with blood; and metimes meningeal hemorrhages occur, or the cerebro-spinal fluid pears stained with hæmoglobin. Sometimes fragments of a thrombus carried into the circulation, and reach the lungs, where they pro-e embolism and its usual consequences.

When thrombosis occurs as a secondary consequence of inflammation the walls of the sinuses, the various products of inflammation are ociated with its development; and if the inflammatory process be ompanied by the transportation of infective masses into the lungs, puration and pyæmia will be developed within the thorax and else-ere.

SYMPTOMS AND DIAGNOSIS. *Thrombosis of the sinuses* frequently exists without characteristic symptoms, but frequently it is accompanied by the usual evidences of meningitis, to which may be sometimes added the phenomena of pulmonary embolism or of pyæmia.

Thrombosis of the superior longitudinal sinus is indicated by distention of the superficial veins which cross the top of the head. The fontanelle in infants is at first depressed, but at a later period it is distended by the accumulation of cerebro-spinal fluid.

In *thrombosis of the transverse sinus* the external jugular vein appears collapsed, since it discharges its blood more readily into the empty internal jugular vein. Œdema is sometimes developed behind the ear.

Thrombosis of the cavernous sinus sometimes produces stagnation of the blood in the ophthalmic veins, œdema of the eyelids, exophthalmus by reason of the distention of the retro-bulbar veins, venous hyperæmia of the retina, choked disc, amblyopia, and sometimes an œdematous swelling of the corresponding half of the face. The ocular muscles and the trigeminal nerve also undergo compression and irritation, or paralysis. Trophic changes may also occur in the eye.

Thrombosis of the sinuses generally runs its course in a few days. Recovery seldom occurs, though the disease is subject to remissions and exacerbations. Feverish symptoms are not uncommon, and death results from exhaustion.

Treatment avails nothing.

Hemorrhagic Pachymeningitis—Pachymeningitis Interna Hæmorrhagica.

PATHOLOGICAL ANATOMY. In certain cases extravasation of blood takes place upon the surface of the dura mater, forming a thin layer of coagulated blood that undergoes a partial organization, and is liable to gradual increase by repeated extravasations from the newly formed bloodvessels. In this way a large quantity of blood and of false membrane may be accumulated between the dura mater and the surface of the brain. The cerebral substance is correspondingly compressed, and deprived of blood through pressure Sometimes inflammatory processes are associated with the extravasation; the membranes of the brain become thickened and adherent to each other, and contain serous or purulent accumulations.

ETIOLOGY. *Hemorrhagic pachymeningitis* is much more common among men than among women. It is caused by injuries, by the extension of inflammation from the neighboring bones and tissues, by excessive alcoholism, by diseases of the brain, particularly those which occasion atrophy of the organ, by disorders of respiration and circulation, and by chronic wasting diseases, especially when characterized by a tendency to hemorrhage.

SYMPTOMS AND DIAGNOSIS In slight forms of *hemorrhagic pachymeningitis* symptoms may be entirely absent; but when the amount of extravasation is sufficient to create pressure upon the brain and upon its sensitive membranes, symptoms are developed. Among these are *headache* that is sometimes located over the seat of hemorrhage. It is

sed that many of the peculiar and *involuntary movements* that are ssed during the stupor that characterizes the last stages of certain es may be ascribed to irritation of the cerebral cortex thus pro-, *e. g.*, picking at the bedclothes, pawing the air, fumbling the ls, etc.

re significant, however, are symptoms that indicate increasing re within the cranium. Such are *apoplectiform seizures*, and a *-like coma* in which the patient sleeps continually, voids urine eces unconsciously, must be fed like an infant, and if aroused about like one in a dream. The pupils are frequently contracted equal and sensitive to light. The wider pupil usually corre-s to the side upon which hemorrhage has occurred. Sometimes *l disc* and unilateral *nystagmus* are observed, and more or less ete *paralysis* is frequently developed. In certain cases the symp-of irritation are prominent and take the form of *convulsions and ctures*, or *conjugated deviation* of the eyes and head may be wit-l. *Irregularity* and *retardation of the pulse* are frequent, and imes *the temperature* is greatly elevated.

certain cases the blood is gradually absorbed, and recovery takes ; but the disease is always attended with danger, which increases portion to the degree of pressure. It is always difficult to recog-he nature of the cause of the symptoms, since they merely indicate crease of intra-cranial pressure.

EATMENT. Alcohol and other stimulants must be removed from iet of the patient. Sometimes a copious bleeding relieves the toms of pressure, but this must not be practised except in cases of ra. The general treatment for cerebral hemorrhage is appro-in cases of hemorrhagic pachymeningitis.

Meningeal Hemorrhage—Hæmorrhagia Meningealis.

THOLOGICAL ANATOMY. *Hemorrhage* may occur into the tissue e meningeal membranes, as may be witnessed in cases of suffoca-or it may occur between the meninges, either between the cranial and the dura mater (epi-dural hemorrhage), between the dura and the arachnoid membrane (sub-dural hemorrhage), into the y tissue that occupies the space between the arachnoid membrane he pia mater (sub-arachnoid hemorrhage), or into and beneath the nater (sub-pial hemorrhage). The extent of such hemorrhages be exceedingly limited, or the extravasation may be so copious surround the entire circumference of the brain, distend the ven-s, and completely fill the spinal canal.

IOLOGY. *Meningeal hemorrhage* is usually caused by *injuries*, g which may be specified the consequences of difficult parturition nstrumental delivery; by *disturbances of circulation*, such as in consequence of thrombosis in the cerebral sinuses, or from the re of aneurisms, or from stagnation of the blood dependent upon ic and pulmonary diseases. Sometimes it occurs in connection *convulsive attacks*, such as occur during the paroxysms of epilepsy tetanus. In certain cases meningeal hemorrhage results from

apoplexia neonatorum may be suspected when the unusually distended after birth.

The characteristic symptoms of meningeal hemor parent when it occurs as a consequence of the r cranial aneurism. The usual symptoms of an ap then developed, and death may follow in a very sho can only occur in cases of very moderate extravasati

TREATMENT. Epi-dural hemorrhage can someti opening the cranium with the trephine; but if thi indicated, the ordinary treatment for cerebral he employed.

CHAPTER II.

DISEASES OF THE BRAIN.

Preliminary Considerations.

DISEASES within the cranium are characterized and by *general cerebral symptoms*. The general signify disorder of the cerebral functions. They vertigo, disorder of sensation and of the intellectual sion of the special senses, vomiting, and modification

Local symptoms are dependent upon definite loc brain. They are characterized by the phenomena paralysis. Local and general symptoms are freque gether.

Local symptoms may be either transitory or per indirect. *Direct symptoms* obviously are the immedi

terior central convolutions and paracentral lobule. The symptoms of disease in this territory depend upon the character of the disturbance, whether it be irritating or paralyzing. *Irritative lesions* produce muscular spasms, while *destructive lesions* of the cortex produce muscular

FIG. 160.

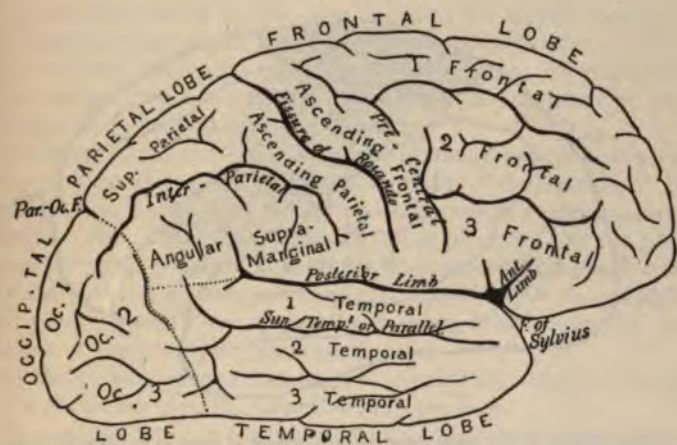
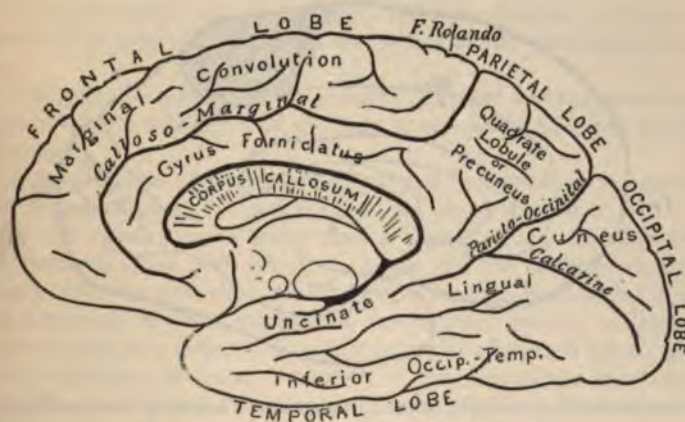


Diagram of the gyri (convolutions) and sulci (fissures) on the lateral surface of the right hemisphere of man. (GOWERS.)

FIG. 161.



The same on the mesial surface. (GOWERS.)

paralysis. A combination of these symptoms indicates the concurrence of irritative and destructive processes in the cortical territory.

The extent to which these symptoms may involve the muscular apparatus of the body depends upon the extension of disease in the cortical region. When the motor centres in the paracentral lobule and the central convolutions are all involved in the process of destruction, complete hemiplegia is the result. Circumscribed lesions are followed by

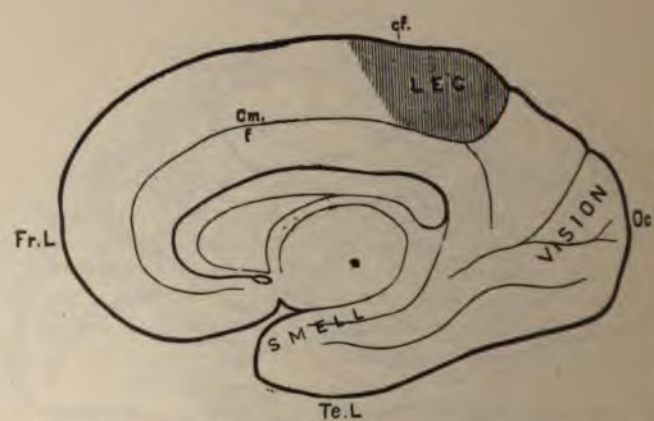
correspondingly restricted symptoms, and monoplegic paralysis u
thus be developed either in the leg, in the arm, or in the facial reg
The frontal branch of the facial nerve, however, escapes paralysis,
that the eyelids may be closed, as they cannot be in peripheral paral

Fig. 162.



The lateral surface of the right cerebral hemisphere of man in outline, to illustrate the cortical areas. Reduced from nature. (Foster.)

Fig. 163.



The mesial surface of the right cerebral hemisphere of man in outline, to illustr the cortical areas. (Foster.)

of the facial nerve. Such phenomena frequently result from injur
the brain, or from embolism or thrombosis of the Sylvian artery,
are often followed by descending degeneration of the pyramidal t
occasioning contractures of the muscles and exaggeration of the t
nous reflexes in the extremities. When recovery takes place,
usually more perfect in the lower limb than in the upper. (Figs.
161, 162, 163.)

The motor centres for the muscles are situated in the paracentral lobule and central convolutions, and are grouped as follows:

1. The cortical motor centre for *the hypoglossal nerve* occupies the lower portion of the anterior central convolution.

2. The cortical centre for *the facial nerve* lies in the lower third of the anterior central convolution.

3. The cortical centre for *the arm* occupies the middle third of the anterior, and perhaps of the posterior, central convolution.

4. The cortical centre for *the leg* occupies the upper two-thirds of the posterior central convolution, the upper third of the anterior central convolution, and the paracentral lobule.

Irritation involving these motor centres produces muscular contraction or spasm corresponding to the extent and intensity of the irritation. In this way epileptiform convulsions, with or without loss of consciousness, may be excited. They differ from ordinary epileptic attacks in the situation and nature of their cause, and constitute what is termed *cortical epilepsy*. Similar epileptiform spasms are frequently associated with symptoms of cortical paralysis, and are generally developed subsequently to the appearance of the paralytic phenomena.

From the preceding considerations it appears that cortical diseases of the brain involving the motor centres may produce:

1. *Monoplegia* without the reaction of degeneration, since the spinal trophic centres remain intact.

2. *Hemiplegia* associated with oculo-motor paralysis, contracture, and exaggerated tendinous reflexes dependent upon secondary degeneration in the pyramidal tracts.

3. *Transformation of monoplegia into hemiplegia*, through the extension of cortical diseases from one motor centre into another motor centre.

4. *Epileptiform spasms or convulsions* that are always restricted to certain groups of muscles, and are only occasionally followed by loss of consciousness.

5. *A combination of paralytic and spasmodic symptoms* in particular groups of muscles, or even assuming a hemiplegic character.

Since the central convolutions (motor zone) furnish an intermediate station between other portions of the brain and the paths of voluntary impulse to the muscles, their motor centres may be excited by disturbances or diseases in other portions of the cerebral cortex. Diseases of the frontal lobe may thus produce disturbances of speech which are indicated by the term *aphasia*. Lesions of the foot of the third frontal convolution are followed by *motor or ataxic aphasia*. Diseases of the cortical portion of the first convolution of the temporal lobe produce disturbances of hearing, which may be associated with *sensory aphasia*, or word-deafness. Diseases of the parietal lobe are followed by *loss of the muscular sense*, so that when the eyes are closed it is impossible for the patient to determine the position of his limbs. In the lower portion of the parietal lobe is situated a centre for *conjugated movements of the eyes*. Irritation of this centre causes the eyes to be directed toward the seat of irritation, while its paralysis is followed by their rotation in the opposite direction. In the angular gyrus is the centre for the levator

FIG. 164.

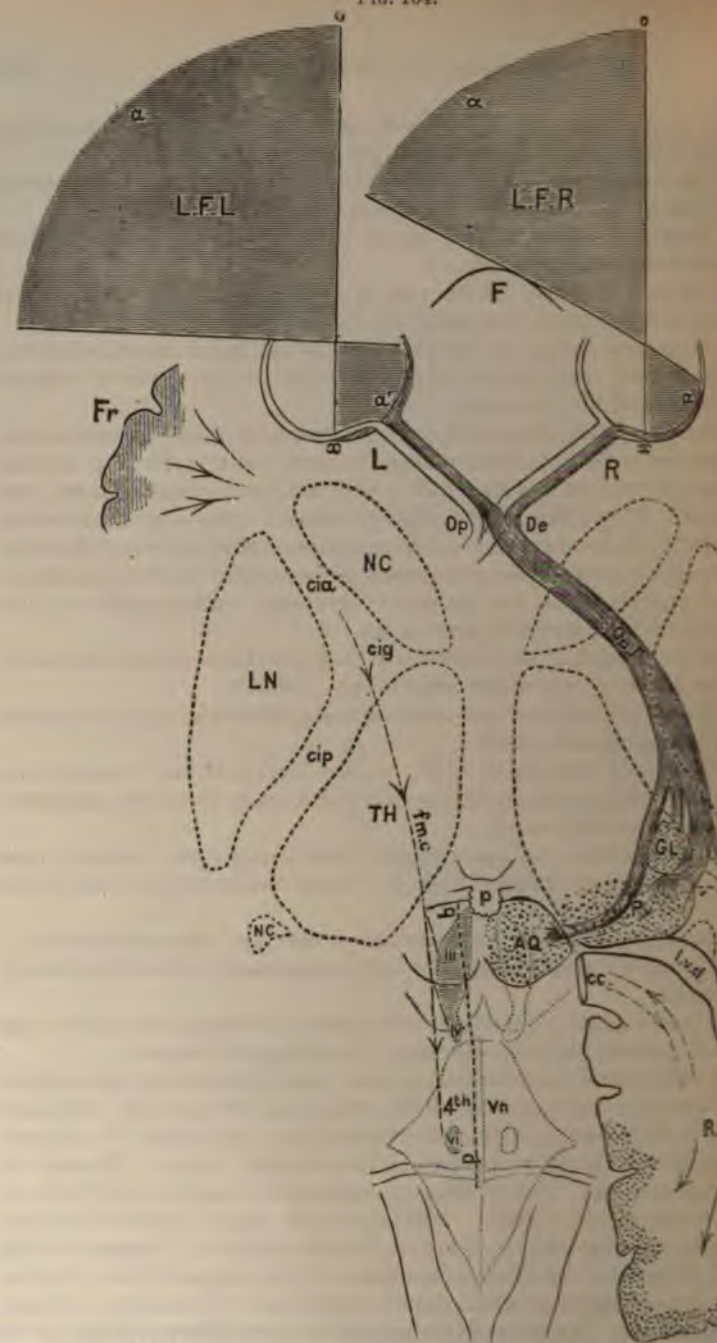


Diagram to illustrate the nervous apparatus of vision in man. (SHERRINGTON.)

L. Left eye. R. Right eye. o—x. Optic axis. Op. T. Right optic tract. Op. decussation. L.F.L. and L.F.R. Right and left visual fields. GL. Lateral ge iculatum. Pv. Pulvinar. AQ. Anterior corpus quadrigeminum. op.rad. Opt tion to R.Oc, the right occipital lobe. d. Direct tract to cortex. cc. Corpus l.v.d. Descending horn of lateral ventricle. Fr. Frontal cortex. fm.c. Path to third, fourth, and sixth nerves. p—b. Posterior longitudinal bundle. NC. Nuc datus. LN. Nucleus lenticularis. TH. Optic thalamus. cia. Front limb. ci and cip, hind limb of internal capsule. p. Pineal gland. R.Oc. Right occipital

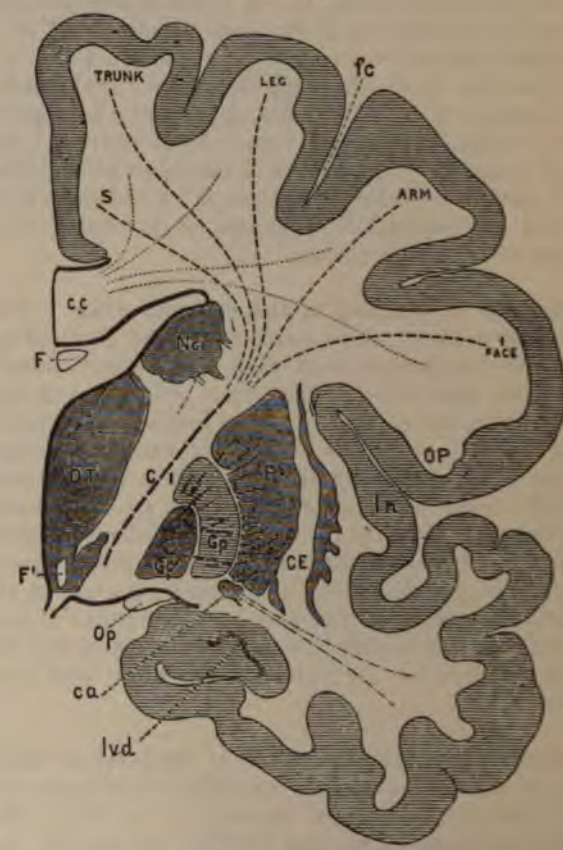
uscle of the opposite eyelid, and its paralysis is followed by *ptosis* on the opposite side. Lesions of the occipital cortex are associated th *hemianopsia*, which may be readily explained by reference to the companying diagram, since the fibres from the temporal half of the e pass directly to the brain without crossing in the chiasm, together th the fibres from the nasal half of the other eye, which have crossed the chiasm. (Fig. 164.) A lesion of their cortical centre is followed paralysis of the temporal half of one retina and of the nasal half of e other, causing the abolition of the corresponding half of the visual ld. Left-sided cortical lesions are thus associated with right-sided mianopsia, and *vice versâ*. In certain cases the visual defect is limited ther to impressions of light, of color, or of spatial perception; and in rtain cases, though the power of vision is not destroyed, the patient n no longer comprehend the nature of the object which he sees. This ndition is termed *psychical blindness*, or *word-blindness* when it is nnected with the perception of written or printed words, and the mprehension of their significance.

Local symptoms in diseases of the centrum ovale. *The centrum ale* contains nerve fibres which connect different portions of the cor- x of the same hemisphere with each other (associational system). ther nerve fibres pass through the *corpus callosum*, and connect cor- sponding points in the cortex of the two hemispheres with each other ommissural system). There is no positive knowledge regarding the mptoms that are produced by diseases of these two systems of nerve bres, but with regard to the nerve fibres which lie in the corona radiata is known that their interruption occasions disturbance in the transmis- on of impressions from without to the posterior cortical portion of the misphere, and of impulses from the cortical structure of the central nvolutions to the pyramidal paths in the spinal cord. It consequently impossible during life to differentiate between diseases of the cortical lls and interruptions in the course of the fibres that make up the rona radiata.

Local symptoms produced by disease of the internal capsule. *The otor fibres* of the corona radiata converge within the middle third of e posterior limb of the internal capsule. (Fig. 165.) The path to e facial nerve occupies the anterior portion; the path for the anterior tremity lies in the middle portion, and the path for the lower limb cupies the posterior portion of the middle third of the capsule. (Fig. 6.) *The sensory fibres* which conduct impressions from the skin, uscles, and cerebral nerves form the posterior third of the posterior mb of the internal capsule. Diseases or injuries of the middle third this posterior capsular limb are, therefore, followed by corresponding *otor disturbances in the muscles of the face or extremities.* The muscles the forehead and the orbicularis palpebrarum muscle, which are con- ected with the upper branches of the facial nerve, escape paralysis, t it is not known whether this depends upon their being provided with separate nerve centre and nerve fibres, or whether it is because the facial erve nucleus is partly innervated from the opposite side of the brain.

The last hypothesis seems to be the more probable. Diseases of motor portion of the interior capsule are seldom limited to that reg since the limitation of cerebral diseases is not conditioned by syste tized arrangements of nervous elements, but is dependent upon the tribution of the bloodvessels. The internal capsule and the cor

FIG. 165.



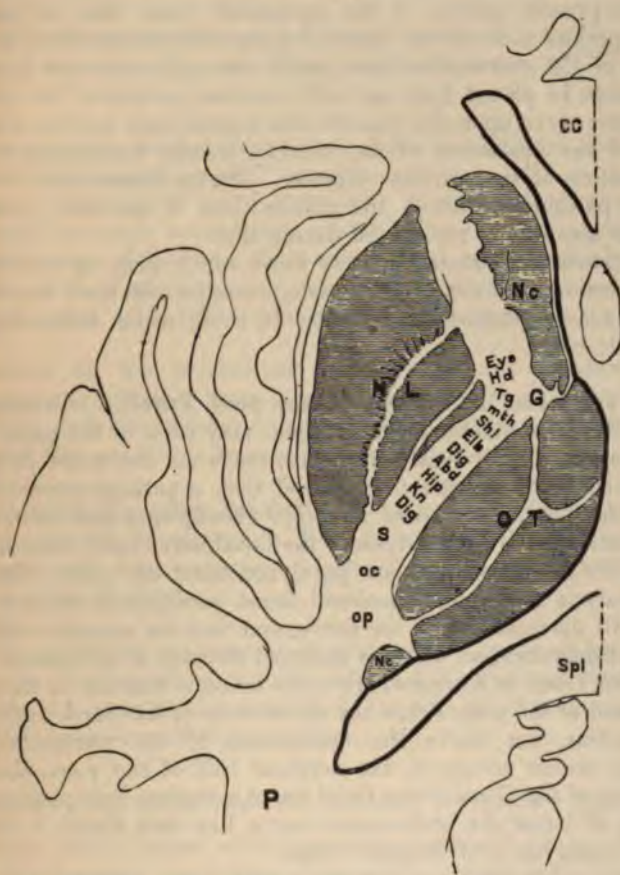
Outline of a transverse dorso-ventral section of the right half of the brain, sho course of the fibres of the corona radiata converging from the cortex to CI, the capsule. Natural size. (SHERRINGTON.)

striatum are supplied by the same bloodvessels and participate same disease-processes. Paralytic symptoms which are associate disease of the corpus striatum are therefore not dependent upo particular locality, but upon the pressure or actual disease that ha sustained by the adjacent motor fibres within the internal capsule

Diseases of the posterior third of the posterior limb of the in capsule involve *sensory nerve fibres*, and occasion *cerebral hemi-an sia*. The entire opposite side of the body, from the crown of the

e sole of the foot, is rendered anæsthetic. *Vasomotor changes*, viz., ase of temperature, vascularity of the skin, and perspiration, are iently connected with such diseases.

FIG. 166.



itline of horizontal section of brain, to show the internal capsule. Natural size. (FOSTER.)

Optic thalamus. NL. Nucleus lenticularis. Nc. Nucleus caudatus. G. Knee of ternal capsule. From *Eye* to *Dig*, marks the position of the pyramidal tract as a . *Eye*, fibres for movements of the eye; *Hd*, of the head; *Ty*, of the tongue; *mth*, mouth; *Shl*, of the shoulder; *Elb*, of the elbow; *Dig*, of the hand; *Abd*, of the nen; *Hyp*, of the hip; *Kn*, of the knee; *Dig*, of the foot. S. Temporo-occipital *oc*, fibres of the occipital lobe. *op*, optic radiation.

ocal symptoms of disease in the basal cerebral ganglia. *Diseases he nucleus caudatus* and of the *lenticular nucleus* produce no per- ent motor disorder. Such transient paralysis as may be observed ependent upon pressure exerted upon the neighboring internal ule.

Local symptoms in disease of the crura cerebri. *Diseases in the crura cerebri* are recognized by the occurrence of alternate hemiplegia involving the oculo-motor nerve. The cerebral motor nerves and the extremities are paralyzed upon the side opposite to the lesion, while the oculo-motor nerve is paralyzed upon the same side with the lesion. Only when the greater portion of the pyramidal tract fails to pass over to the opposite side at the point of pyramidal decussation, does the paralysis of the extremities occur upon the same side with the lesion. If the lesion be placed high up in the cerebral portion of the crus, the oculo-motor nerve upon the opposite side is paralyzed, and the symptoms partake of the characters of an ordinary crossed hemiplegia such as follows lesions of the internal capsule. Minute lesions that do not involve the pyramidal path in the middle third of the crus produce no symptoms that can be recognized during life.

The tegmentum contains sensory fibres which pass upward into the sensory portion of the internal capsule, consequently their interruption produces sensory disturbances similar to those which follow injury of the capsule itself.

Local symptoms in disease of the pons Varolii. *Circumscribed diseases*, like the tubercular formations, may exist in the pons Varolii without producing any local symptoms; but when the motor path is injured a form of hemiplegia is produced that is pathognomonic for diseases of the pons. A *crossed paralysis* (hemiplegia alternans) occurs, and is characterized by paralysis of the facial nerve upon the side of the lesion, while the extremities are paralyzed upon the other side. The facial paralysis resembles peripheral facial paralysis in the fact that it involves all the branches of the nerve, and that the muscles exhibit the reaction of degeneration which is observed in cases of peripheral paralysis. This result is witnessed when the lesion is situated in the medullary portion of the pons, below the decussation of the fibres to the facial nerve nucleus, but above the decussation of the pyramidal paths. When the lesion occurs in the cerebral half of the pons, above the decussation of the fibres to the facial nerve, complete hemiplegia occurs, involving all below the oculo-motor nerve, like that which is observed when the paralysis is of cerebral origin.

Lesions in the pons are sometimes followed by disturbance of the nerves that spring directly from its neighborhood, or of the bulbar nerves immediately below, as a consequence either of direct paralysis or of indirect influences exerted from a distance. *Conjugated deviation of the eyes and head* are sometimes observed, but this symptom differs from conjugated deviation of cerebral origin in the fact that the head and eyes are turned away from the side of the lesion.

Diseases of the pons are frequently accompanied by great *elevation of the temperature;* and if the lateral third of the pons be involved, *anæsthesia* is sometimes observed upon the same side of the body with the motor paralysis. The symptoms that follow diseases of the pons obviously vary according to the extent and situation of the disease, consequently a great variety of permutations becomes possible, requiring great anatomical facility for their explanation.

Diseases of the thalamus opticus produce no motor symptoms. Diseases in its posterior third occasion *lateral hemianopsia*, like diseases of the occipital cortex. Other disturbances of motion and sensation associated with thalamar lesions are occasioned by pressure upon the neighboring limb of the internal capsule.

Diseases of the external capsule and claustrum produce no recognizable symptoms. The same thing is true of *diseases of the Ammon's horn.*

Diseases of the corpora quadrigemina are associated with disturbances of vision, paralysis of the ocular muscles, and defective equilibration of the body. Loss of sight, with pupillary paralysis and negative ophthalmoscopic appearances, are associated with the *anterior pair of the corpora. Injuries of the posterior pair* produce paralysis in the branches of the oculo-motor and trochlear nerves, and are accompanied, in certain cases, by the symptoms of cerebellar ataxia.

Diseases of the cerebellum are not attended by characteristic symptoms. The hemispheres may be involved without any consequent symptoms, and the association of a staggering gait and vertigo with lesions of the vermiform process is still disputed.

Diseases of the crura cerebelli produce no symptoms, except when the crus cerebelli ad pontem is merely irritated. Certain compulsory movements of a rotary character, twisting around the axis of the body, etc., are then observed.

Local symptoms in diseases at the base of the brain are indicated chiefly by paralysis of the cerebral nerves through compression. When the posterior cerebral fossa is invaded, the symptoms may resemble the course of *progressive bulbar paralysis.*

Aphasia—Agraphia—Alexia—Amimia—Apraxia—Asymbolia.

Certain local diseases of the cerebral cortex and corona radiata produce disturbances in that power of expression by which the individual is enabled to communicate his thoughts and feelings to the external world. When this disability involves the power of speech, it is termed *aphasia;* when the power of reading is lost, *alexia;* when the power of communicating thought by gestures is destroyed, it is termed *amimia;* when the comprehension of the nature and uses of objects disappears, the condition is termed *apraxia.* By the term *asymbolia* is signified the loss of all power of communication with the external world.

Simple *aphasia* consists in the loss of the power of vocal utterance. This may depend either upon injury of the voluntary path between the cerebral cortex and the vocal organs (motor or ataxic aphasia, subcortical motor aphasia), or it may be the result of an interruption in the sensory path between the recipient organs of sense (eye, ear, etc.), and the cortical centres of perception and comprehension (sensory

aphasia). The mechanism of aphasia may be conveniently studied in connection with auditory lesions, involving the cortical paths and centres between the nucleus of the auditory nerve and the nuclei of the motor nerves that control the muscles of articulation. This may be rendered intelligible by reference to the accompanying schematic representation. (Fig. 167.) The fibres in the posterior portion of the

FIG. 167.

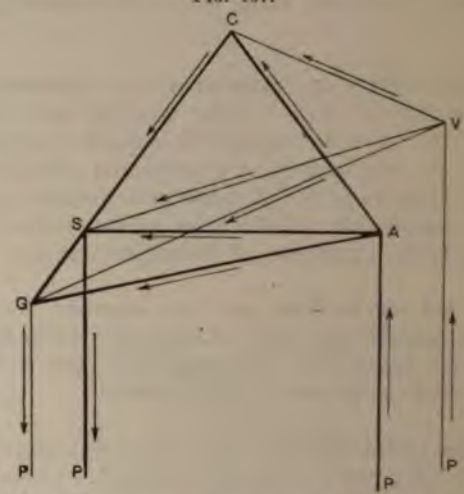


Diagram illustrative of the mechanism of auditory and visual perception, conception, and vocal or graphic utterance. (After EICHHORST.)

A. Cortical auditory centre. V. Cortical visual centre. C. Cortical centre for the conception of ideas. S. Cortical centre for coördination of the muscles of speech. G. Cortical centre for coördination of the muscles used in writing. A P. Sub-cortical sensory path for auditory impressions. V P. Sub-cortical sensory path for visual impressions. A C and V C. Trans-cortical sensory paths. A G, A S, V G, V S, C G, and C S. Trans-cortical motor paths. S P and G P. Sub-cortical motor paths.

internal capsule and corona radiata that lie between the auditory nerve nucleus and the cortical centre for auditory perception, constitute the sub-cortical sensory path. The perceptive centre is located in the first temporal convolution. The cortical centre for vocal utterance occupies the base of the third frontal convolution. The association fibres in the neighborhood of the island of Reil, between the third frontal convolution and the first temporal convolution, form the path of communication between the auditory centre and the centre for vocal utterance. Perception takes place in the first centre, voluntary impulse to utterance is excited in the other. The centre for comprehension of perception is connected with the perceptive centres by the fibres of the trans-cortical sensory path, and with the vocal centre by the fibres of the trans-cortical motor path. If now the sub-cortical sensory path be interrupted, auditory perception cannot occur (sub-cortical sensory aphasia); and a similar result follows destruction of the auditory perceptive centre itself (cortical sensory aphasia). In this way word-

deafness may be produced. The patient hears, so far as the ear is concerned, but he cannot perceive or comprehend the meaning of the sounds that are received by the brain, though he can still think, and utter his thoughts through the intervention of the cortical centre for comprehension and the trans-cortical motor path that connects it with the cortical vocal centre.

If now the path between the auditory centre and the vocal centre be interrupted, the patient can hear and comprehend what is addressed to him, and can voluntarily utter his own thoughts; but he cannot repeat the words that he hears.

If the trans-cortical sensory fibres between the auditory centre and the centre for comprehension be interrupted, the patient can hear words, and can repeat them; but he cannot comprehend their meaning, though able voluntarily to utter his own thoughts (trans-cortical sensory aphasia). The utterances of such a patient are liable to some degree of confusion, since his memory of words is no longer controlled by intelligible audition.

Destruction of the centre for comprehension is attended with loss of the power of comprehending the nature and uses of the objects of perception (apraxia).

Interruption of the trans-cortical motor path between the centre of comprehension and the vocal centre is attended by perfect auditory perception and comprehension, also by the power of repeating words that are heard, and of performing such acts as are audibly commanded; but he is unable to express his thoughts by vocal utterance. Such cases constitute what is frequently termed *amnesic aphasia*. Since the difficulty of voluntary utterance is associated with forgetfulness of the necessary words, the more intimate the relation between word and idea the more easily is its memory lost; while ideas that are connected with actions rather than with words are longer retained. Hence the ready forgetfulness of proper names and substantives, while verbs, the words of action, are longer retained in the memory. This variety of aphasia is termed *trans-cortical motor aphasia*.

If now the vocal centre be injured (motor aphasia), or if the fibres between that centre and the nuclei of the nerves that arouse the muscles of articulation be interrupted (sub-cortical motor aphasia), sensation, perception, and comprehension of audible sounds may be complete, but the utterance of voluntary thoughts and the repetition of audible words will be rendered impossible. If the sub-cortical paths between the volitional centres and the muscles of the extremities remain intact, it may be still possible for the patient to express his thoughts in writing or by gestures.

Similar disturbances of expression must obviously accompany corresponding lesions of the sub-cortical paths and cortical centres that are concerned in the perception and comprehension of visual impressions, or any other impressions of sense and their cerebral paths of communication with the vocal centres, or with other centres for the coördination and communication of central impulses to the external world.

It is an interesting fact that *aphasic symptoms* are usually dependent upon *lesions involving the left hemisphere of the brain*. This is appar-

ently due to the greater development of that hemisphere in consequence of its more perfect supply of blood during the period of development, and of other causes that have given it the preference as the organ of expression. When aphasia occurs in connection with lesions of the right hemisphere of the brain, it is usually observed in left-handed persons.

The seat of those lesions by which the different forms of aphasia are produced is, in the great majority of cases, within the territory that receives its vascular supply from the branches of the Sylvian artery. Rupture or obstruction of those vessels may produce aphasia as a consequence of compression or softening of the cortical tissues; but aphasia may also be the result of direct injuries of the cortical substance, such as are observed after fractures of the skull with depression of the interior table of the bone, producing compression and paralysis at the foot of the third frontal convolution. Similar consequences may be developed by tumors and by the products of inflammation, when they compress the centres and paths of voluntary utterance. The same thing may happen as a consequence of microscopical changes in the cortex, by reason of which the cortical ganglionic cells undergo atrophy and disappear. It occasionally happens that transient aphasia may be witnessed as a consequence of modification of the circulation in hysteria, chorea, catalepsy, and after epileptic seizures, or by reason of irritation that has its origin in the alimentary canal under the influence of parasites or obstinate constipation of the bowels. In similar cases the power of speech is sometimes suddenly restored through excessive emotion or intellectual excitement.

CHAPTER III.

DISEASES OF THE CEREBRUM.

Cerebral Anæmia—Anæmia Cerebri.

PATHOLOGICAL ANATOMY. *Cerebral anæmia* is characterized by a deficiency of blood in the vessels of the brain and of the pia mater. There is universal pallor of the cerebral substance, together with abnormal reduction of its fluid constituents, when anæmia is caused by hemorrhage or other conditions that greatly diminish the liquids of the body; but in cases of dropsical anæmia the cerebral tissue may be unusually soft and soaked with fluid.

ETIOLOGY. The *causes of cerebral anæmia* are frequently dependent upon *excessive hemorrhage*, or upon the sudden abstraction of fluids from any of the great cavities of the body. It may occur as a consequence of *shock*, by which the abdominal vessels are excessively dilated and compelled to detain the greater portion of the blood from the rest of the body.

Cerebral anæmia is frequently observed among young children, as a consequence of profuse and exhausting *diarrhœa*, and it often results from other diseases that are attended by great *impoverishment of the blood*. When the number of red blood-corpuscles is considerably diminished, the circulation of such blood is followed by the symptoms of anæmia in the brain and elsewhere.

Cerebral anæmia may result from *embolism* or *thrombosis* in the cerebral vessels, or from their *compression* by tumors, hemorrhages, or exudations within the cavity of the cranium. *Arterial* and *venous diseases* and *cardiac debility* may interfere with the proper supply of blood to the brain.

Vasomotor spasm, under the influence of violent emotion, or excited by certain poisons, frequently results in temporary cerebral anæmia.

SYMPTOMS. One of the most common and perfect illustrations of the consequences of *cerebral anæmia* is furnished by the occurrence of *syncope*, or fainting. This condition is brought about by a sudden spasm of the cerebral vessels, shutting off the supply of blood, for the time being, from the cortical tissues. The vascular spasm is usually excited by violent emotion; the patient experiences a sensation of constriction and distress in the region of the heart, sometimes accompanied by palpitation; there is an inclination to yawn, a sensation of cold creeps over the skin, and the countenance becomes pale, the ears ring, sounds grow faint, sight fails, the constricted pupils become dilated, everything is in a whirl, and perhaps nausea is experienced. The muscles of the face and of the fingers begin to twitch, consciousness is lost, and the patient falls as if lifeless to the floor. Death sometimes follows the appearance of these symptoms, but generally after the lapse of a few seconds the patient heaves a deep sigh, and speedily recovers.

Severe epileptiform convulsions are sometimes associated with these symptoms when accompanied by excessive loss of blood. Young children frequently display similar phenomena in lesser degree during a considerable period of time as a consequence of exhausting diarrhœa. In such cases the child lies cool and pale, with sunken fontanelles and wasted visage, while delirium and slight spasmodic movements manifest the existence of cerebral irritation. As the disease progresses, irritation gives way to utter exhaustion. Coma, asphyxia, and death conclude the scene, thus furnishing an excellent illustration of the manner in which paralysis and irritation may be associated, or succeed one another, as consequences of cerebral anæmia.

Similar consequences are not unfrequently observed among grown people in the course of exhausting diseases. Violent delirium, sometimes attaining to maniacal proportions, may be suddenly developed, and after raging for a time may be merged in somnolence and coma.

Besides the symptoms already mentioned, headache, dizziness, paræsthetic disturbances of ordinary sensation, and perversions of the special senses are not uncommon. In many cases the symptoms are greatly aggravated by sudden assumption of the erect position, leading occasionally to fatal syncope.

TREATMENT. So far as possible the causes of anæmia must be ascertained and removed. Correct hygiene, abundant and wholesome

diet, and a healthy habitation in a salubrious locality, must be secured. A tendency to syncope may be obviated by placing the patient upon a bed with the feet elevated above the level of the head. Ammonia, mustard, and other external stimulants may be employed. Wine, whiskey, coffee, tea, beef-tea, and valerianate of ammonia may be administered internally, while ether may be injected hypodermically, in ten-drop doses every five or ten minutes, or a syringeful of a ten per cent. solution of camphor in oil of almonds may be employed in the same way. Cerebral excitement and loss of sleep require the administration of opiates, paraldehyde (one or two drachms at bedtime), or chloral hydrate (half a drachm at a time). Chronic cases are sometimes benefited by the use of electricity.

Cerebral Hyperæmia—Hyperæmia Cerebri.

Hyperæmia may be either acute or chronic, active or passive. *Active hyperæmia* is often dependent upon excessive energy of the heart when that organ has undergone concentric hypertrophy. It may also occur when a considerable portion of the arterial circulation is cut off by the compression of tumors or other causes of arterial constriction, so that the brain is subjected to an unusual afflux of blood. This may also result from the suppression of customary hemorrhagic discharges. It is sometimes produced by paralysis of the vasomotor nerves, such as occurs during violent mental excitement, or as a consequence of the excessive use of alcohol. It sometimes is associated with inflammatory diseases about the head and in the neighborhood of the brain.

Passive cerebral hyperæmia may result from thrombosis of the cerebral sinuses, or from obstruction of the jugular veins, or as a consequence of cardiac and respiratory diseases that interfere with the ready return of blood from the head.

Pathological Anatomy. *Cerebral hyperæmia* occasions extensive dilatation and distention of the cerebral bloodvessels. The cerebral cortex appears unusually dark in color, and the white substance of the centrum ovale is in like manner slightly discolored and marked by the appearance of droplets of blood in unusual number at the orifices of the incised bloodvessels. *Microscopical examination* reveals a distended condition of the lymphatic sheaths of the bloodvessels, and they frequently contain red blood-corpuscles that have escaped in considerable number from the vessels themselves. The *ganglionic cells* are frequently loaded with yellow pigment, and the *neuroglia* is somewhat increased in quantity. In chronic cases the cerebral tissues undergo a certain amount of atrophy.

Symptoms and Diagnosis. The symptoms of *cerebral hyperæmia* agree, in many respects, with those of cerebral anæmia. In both cases a stage of irritation is liable to be followed by a stage of paralysis. Irritative symptoms usually depend upon active arterial hyperæmia, which occasions compression, and suppression of function, in the cerebral tissues.

Irritation of the brain is indicated by psychical disturbances. The patient becomes excitable and incapable of clear and steady thought.

Not unfrequently delirium occurs, and it may reach the height of maniacal fury. Sleep is disturbed by agitated and exhausting dreams. Dizziness, headache, sensations of heat, confusion of ideas, and loss of consciousness are not uncommon. Sometimes apoplectiform attacks are experienced. Common sensation undergoes various paræsthetic modifications, *e. g.*, numbness, formication, sensations of heat; and the special senses are more or less involved, so that there is complaint of seeing sparks, of dimness of vision, roaring in the ears, difficulty of hearing, etc. Sometimes light and sound become intolerable by reason of the exalted condition of the sensory organs.

In certain cases convulsive symptoms are manifested, rendering it difficult to distinguish the case from an attack of genuine epilepsy. Sometimes transient paralysis is observed.

Cerebral hyperæmia may exist as a constant condition, or it may occur paroxysmally for a comparatively brief period of time. During an attack the face is highly colored and somewhat swelled. If hyperæmia is of a *passive character*, the skin appears cyanosed, the heart beats rapidly, with a full, hard pulse in congestive cases, but it is soft and often almost imperceptible in the passive form of the disease. Respiration is frequently irregular, and becomes stertorous in cases of coma or of apoplectiform seizure. Sometimes the temperature is slightly elevated. Vomiting may occur.

Prognosis and Treatment. The *prognosis* depends upon the nature of the cause that operates to produce cerebral hyperæmia. It is unfavorable in epileptiform or apoplectiform varieties of the disease. The *treatment* must also depend upon the nature of each individual case. Cardiac weakness and passive hyperæmia require the administration of digitalis; while active hyperæmia must be relieved by change in the diet and habits of life, together with the administration of cathartics and laxative mineral waters. Severe paroxysms of hyperæmia in plethoric subjects may require the abstraction of blood. Ice should be applied to the head, and an active cathartic should be administered. The feet may be placed in hot water, and a low diet should be ordered. Sleeplessness must not be treated by the administration of opiates or chloral hydrate. Large doses of bromide of potassium or of sulphonal are followed by a more favorable result. Chronic cerebral hyperæmia is sometimes benefited by the use of electricity about the head and neck.

Sunstroke—Thermic Fever—Insolatio.

Exposure to excessive heat is sometimes followed by severe symptoms of general prostration, cardiac failure, cerebral hyperæmia, and death. But if recovery takes place, convalescence is tedious and imperfectly terminated, sometimes resulting in a chronic condition of cerebral exhaustion or chronic inflammation.

Etiology. *Sunstroke* usually follows exposure to the rays of the sun during the heat of summer, or in tropical climates. Artificial heat, especially when combined with ill-ventilation and stagnation of a humid atmosphere, may also produce the disease. It is thus witnessed among

coal-heavers and firemen on the steamships that traverse the Red Sea and other torrid regions. It is sometimes also experienced during the night when the weather is sultry and the air is stifling. A warm and reeking atmosphere is much more prejudicial than dry heat. Cases of sunstroke sometimes occur when the temperature of the air scarcely exceeds 80° F., because when laden with moisture it cannot evaporate perspiration from the body, and heat consequently accumulates in the tissues. But when the air is dry, a high temperature actually refrigerates the body by the rapid evaporation of perspiration which it produces.

The effects of a high temperature are rarely prejudicial to a person in complete health. It is when the nervous system has been exhausted by previous illness, fatigue, or debauchery, that the individual succumbs to insolation. The controlling influence of the nervous system over the production, distribution, and liberation of heat, is under such circumstances diminished, and the tissues are therefore unable to adjust themselves to an excessive temperature. Imperfect elimination through the kidneys, intestines, and skin adds to the disorder of the system; and by the accumulation of poisonous excreta subjects the nervous centres to influences of a toxic character, by which their regulative power over the functions of circulation and nutrition is inhibited. These morbid conditions are greatly aggravated by chronic alcoholism, and by the excessive use of cold water when overheated.

Symptoms. Mere exposure to the direct rays of the sun on the part of a healthy person produces nothing worse than an erythema of the skin upon the parts that are exposed. A thin and delicate cuticle is not unfrequently blistered under such circumstances; but, after a time, through repeated exposure, it becomes thickened, hardened, pigmented, and correspondingly insensitive to the effects of solar heat. When the inhabitants of the temperate zone remove to tropical climates, they frequently experience a brief course of fever, lasting for a week or ten days, and terminating in recovery. This *thermal fever* is usually referred to the direct effects of heat, but it is probably caused in great measure by a disturbance of the thermic centres in the brain, under the influence of a diet and habits of life that have been only imperfectly adjusted to the change of climate.

A sunstroke is usually preceded for several days, by symptoms of ill health. The bowels are frequently constipated; there is loss of appetite, and indigestion is developed; the urine becomes scanty, though a frequent desire to urinate is experienced; perspiration is more or less suppressed; there is a feeling of general exhaustion, with disinclination to active exercise; dizziness, headache, loss of memory, vertigo, and a disposition to sleep are often observed.

The attack is manifested under two principal forms. *In the first* the symptoms of cardiac exhaustion are most conspicuous. The patient falls to the ground, complaining of pain in the præcordial region. Respiration is somewhat difficult; the face is pale, and symptoms of intense prostration are manifested. Under favorable circumstances, however, recovery may take place in the course of two or three days, though in many instances the attack is succeeded by persistent debility and incapacity for active exertion. Sometimes it is impossible to en-

dure subsequent exposure to a high temperature. Obstinate headaches are often experienced, and the patient exhibits great deterioration in bodily health, intellectual vigor, and psychical character.

A severe attack is ushered in with similar promonitory symptoms. There is intense headache; the face is sometimes swelled; the pupils are contracted; respiration is irregular and labored; the heart beats rapidly, irregularly, and feebly; nausea and vomiting are sometimes experienced; the skin is hot and dry, or sometimes covered with perspiration; the temperature rises to 106° or 110° F.; convulsions are occasionally witnessed, and the patient passes rapidly into a condition of profound coma. The pupils then dilate; respiration becomes stertorous; mucous râles develop in the trachea; foam appears upon the lips; the skin is cyanosed; and death speedily follows.

After a mild attack recovery is completely established in the course of two or three days; but severe forms of the disease either terminate fatally in the course of a few hours, or in recovery after a long and tedious illness, characterized by a febrile movement and symptoms of subacute meningitis. Contractures and muscular atrophy are sometimes developed as sequelæ of the disease. In malarious countries and during the prevalence of yellow fever, the occurrence of sunstroke is often followed by pernicious fever or by yellow fever itself.

Pathological Anatomy. The *temperature* of the body remains for many hours after death elevated above the normal standard. *Rigor mortis* is rapidly developed. *Livid spots* and *ecchymoses* are frequently observed upon the skin, and a sanguinolent fluid trickles from the mouth and nostrils of the cadaver. The *left side of the heart* is empty, but the *right side* and the *large veins* are distended with black, fluid blood. The *cerebral sinuses and veins* are engorged with blood, and a considerable amount of serum occupies the cavities of the membranes and the ventricles. The *cortex of the brain* is congested, and sometimes punctate hemorrhages exist in the cerebral substance. The *lungs* are excessively congested; the *bronchi* are filled with sanguinolent froth; and not unfrequently the *pleural cavities* contain a large quantity of blood-stained fluid. The *liver* and *spleen* are always congested. The *gastro-intestinal mucous membrane* exhibits a similar tendency; and the *kidneys* are usually overloaded with blood.

Diagnosis. The circumstances under which the attack is developed, and the high temperature of the body, usually exceeding that of any other acute disease, render the diagnosis easy.

Sunstroke must be differentiated from cerebral hemorrhage, from cerebro-spinal meningitis, and from the cerebral form of pernicious fever.

Cerebral hemorrhage is accompanied by a violent rending pain in the head. There is sometimes sufficient preservation of consciousness to enable the patient to call for assistance before falling to the ground. There is usually the development of hemiplegia, and if paralysis be total, it is more pronounced upon one side than upon the other, while in the case of insolation there is complete paralysis and insensibility. The temperature is very slightly elevated after cerebral hemorrhage, and the pulse and respiration do not exhibit that excessive disturbance which characterizes a sunstroke.

Cerebro-spinal meningitis is characterized by intense headache, which involves the back of the neck and the spinal column. There are vertigo, nausea, and vomiting. Convulsive movements agitate the limbs; the head is drawn backward; there is no paralysis. The temperature is but moderately increased, and the pulse seldom rises above 100 or 120 beats.

Pernicious malarial fever usually occurs during the course of an ordinary malarial fever. The temperature does not rise above 104° or 106° F., and rapidly subsides with the decline of the paroxysm.

PROGNOSIS. In severe cases sunstroke usually proves fatal. The average mortality is probably about 40 per cent.

TREATMENT. The clothing of persons who are exposed to a high temperature should be light and loosely girded, so as to favor the rapid evaporation of perspiration. An abundance of cool water should be furnished to compensate for copious evacuation through the skin. Total abstinence from intoxicating drinks, and strict observance of the ordinary rules of hygiene should be enjoined. Constipation must be prevented, and the functions of the alimentary canal must be maintained in a state of normal health. Thus guarded, it becomes possible to endure the most intense solar heat without serious injury.

But when a sunstroke has been experienced the patient should be placed in a cool and shaded place, and all unnecessary clothing should be removed. Cold water should be poured freely over the head, neck, and entire body, so as to reduce the temperature as rapidly as possible. In minor forms of the attack, coffee with a little brandy, aromatic spirits of ammonia, and other gentle stimulants, may be administered. As soon as recovery occurs, a cathartic dose of calomel may be administered and followed by tonic doses of quinine. In severe forms of the disease characterized by coma, ice should be freely used about the head and entire body. A large injection of ice-water may be thrown into the bowels in order to cool the interior of the abdomen. Convulsions should be relieved by the hypodermic injection of one-tenth of a grain of apomorphia. When the symptoms exhibit a tendency to profound asphyxia, indicated by cyanosis of the skin and distention of the veins, copious bleeding from the arm will sometimes revive the circulation and rescue the patient. During the period of restoration, when the symptoms of thermic fever are developed, phenacetine may be given in doses of five or ten grains every two hours until the temperature is reduced. Convalescence should be aided in accordance with general principles.

Cerebral Œdema—Œdema Cerebri.

Cerebral œdema occurs in connection with those diseases of the circulatory apparatus, or of the blood that lead to dropsical effusions in other parts of the body. It occasions symptoms of intra-cranial pressure accompanied by interference with, and final paralysis of the cerebral functions (serous apoplexy).

Cerebral Hemorrhage—Encephalorrhagia.

Cerebral hemorrhage is more common among men than among women. It is a disease of old age, and occurs with increasing frequency

as one recedes beyond the fortieth year. Hereditary causes are probably not without influence, since the disease is often observed among relatives in the same line of family descent.

Cerebral hemorrhage in the vast majority of cases is caused by changes in the walls of the cerebral bloodvessels. These morbid processes are usually dependent upon old age, but they may exist as a consequence of chronic renal disease, alcoholism, syphilis, lead poisoning, and valvular disease of the heart. Under such circumstances, vascular rupture may occur through the influence of any accidental increase in the pressure of the blood; but frequently it happens during sleep, without any apparent exciting cause.

Pathological Anatomy. *Superficial hemorrhage* upon the external surface of the cerebrum causes distention of the cerebral membranes, and the bloody extravasation sometimes finds its way into the spinal canal. The convolutions of the brain are sometimes compressed and rendered anæmic, as a consequence of the exclusion of blood from their vessels through pressure exerted by the hemorrhagic clot. The *quantity of blood that is effused* exhibits great variations. In the majority of cases hemorrhage takes place upon one side only of the brain; but successive hemorrhages may occur, involving now one hemisphere and then the other. In the pons Varolii hemorrhages near the median line may involve both sides at once.

When first extravasated, the seat of hemorrhage is occupied by a mass of red, coagulated blood, mixed with fragments of cerebral tissue. In certain cases there is nothing more than *punctate hemorrhage* from minute capillary vessels, but this may in time occasion a considerable accumulation of blood. Gradually the blood corpuscles are broken up, and by the separation of their pigment a dark-colored mass is formed that contracts, and floats in a serous fluid that is retained by a capsular wall of thickened connective tissue, constituting an *apoplectic cyst*. In many cases the contents of such cysts contain minute oil globules and fatty cells, together with crystallized pigment from the blood corpuscles. Gradually contraction takes place, and a pigmented mass of cicatricial tissue occupies the seat of the original hemorrhage.

Examination of the bloodvessels, in cases of cerebral hemorrhage, indicates the existence of numerous minute miliary aneurisms that are usually developed at the bifurcation of the arterial twigs. The process consists in the development of inflammatory or sclerotic changes in the walls of the arteries, by which their muscular coat is destroyed so that the endothelial lining is pushed outward and blends with the lymph-vascular sheath, to form the aneurismal wall. These minute aneurisms are most numerous in the thalamus opticus and corpus striatum; then, in order of frequency, in the cerebral cortex, in the pons, in the medulla oblongata, and in the gray matter of the cerebellum.

Symptoms. *Prodromal symptoms* consist, for the most part, of pressure of blood into the head, dizziness, dimness of vision, black specks before the eyes, roaring in the ears, and partial loss of hearing, general discomfort, and sense of constriction. There is evident loss of memory, and of the power of mental concentration and effort, disturbance of the emotional nature, distressing dreams, and restless sleep.

Sometimes there are tingling sensations and feelings of numbness and weakness in the extremities. These symptoms may be developed rapidly, or they may persist for a long time before the culmination of an attack.

The apoplectic seizure usually develops itself quite rapidly. In certain cases the patient falls insensible to the floor, but in other cases the power of motion disappears gradually, and consciousness vanishes at a later period, or not at all. In the severest forms of the disease death may occur almost immediately, but in milder cases, though comatose, the patient will respond to a pinch or a prick by opening the eyes, moving the limbs, and uttering a groan. In severe cases accompanied by complete coma it is often impossible to determine the existence of hemiplegia since all the extremities appear equally relaxed, but in less completely developed attacks unilateral paralysis may be usually demonstrated without difficulty. The observer should be cautious, in severe cases lest he mistake apoplexy for alcoholic intoxication or poisoning with opium. In the first case, the odor of alcohol does not always exclude apoplexy, since intoxicated persons may also suffer with cerebral hemorrhage. Opium poisoning is accompanied by contraction of the pupils and their dilatation during coma should lead to the suspicion of cerebral hemorrhage.

When *hemiplegic symptoms* are present, the paralyzed side of the face moves only during the acts of respiration. The ala nasi and the paralyzed lips and cheek are puffed out and passively drawn in with each expiration and inspiration. The powerless limbs fall lifeless by the side of the patient, and offer no resistance to passive movements. The cutaneous reflexes disappear upon the affected side; and when hemorrhage involves the motor zone of the cerebral cortex, or the pons Varolii, or when the walls of the lateral ventricles of the brain have been broken down by extensive clots, unilateral spasms and contractures or epileptiform convulsions are frequently observed. Sometimes there is conjugated deviation of the head and eyes toward the seat of hemorrhage, when it involves the cortical portion of the parietal convolutions (gyrus supra-marginalis). The *circulation* exhibits variable conditions. In certain cases the pulse is full, hard, and slow; in others it is rapid, soft, and weak. The *face* may be either flushed, and damp with perspiration, or pale and cool. *Respiration* may be slow, stertorous, and deep and irregular. During the stage of irritation the *pupils* are contracted. As this stage merges into a condition of great cerebral pressure and profound paralysis, the pupils become unequal, and finally they are widely dilated. *Vomiting* is not an uncommon event. The *temperature* falls for a short time, and if a fatal termination be imminent it rises to an extraordinary degree, except in those fulminant cases where death occurs almost immediately.

The return of consciousness after an apoplectic seizure is sometimes quite sudden, especially after copious bleeding; but usually it occurs gradually, and may sometimes require many days for its completion. In *fatal cases* coma deepens, pulse and breathing fail, the skin becomes cyanosed; noisy, tracheal râles impede respiration, and death occurs in a condition of complete collapse. Apparent recovery is not unfre-

quently followed by successive relapses until at last a fatal termination is reached.

The period of reaction after an apoplectic attack is usually characterized by delirium, fever, with considerable elevation of temperature, and more or less pain, accompanied by slight spasms and contractures in the paralyzed limbs. These spasms are the consequence of irritative inflammatory processes in the tissues around the seat of hemorrhage.

The permanent results of cerebral hemorrhage are developed in cases of recovery during the period of convalescence. They are characterized by symptoms of a local character, which vary according to the seat and extent of the cerebral lesion. Hemorrhage into the internal capsule and neighboring ganglia is the favorite seat of cerebral hemorrhage that produces motor hemiplegia. Sensory disturbances frequently exist for a short time, but soon disappear as pressure is removed from the sensory fibres of the internal capsule. The muscles upon the non-paralyzed side of the body are somewhat weakened, though still capable of voluntary movement. The muscles of the forehead and the orbicular muscles of the eyelids do not share in the paralysis of the other facial muscles. The tongue, when protruded, deviates toward the paralyzed side in consequence of the failure of the genio-glossus muscle upon that side. The intercostal and abdominal muscles also suffer, so that their movement is less vigorous upon the paralyzed side than upon the other. Unless descending degeneration is developed in the pyramidal tract and invades the anterior cornu, the muscles remain without atrophy or loss of their normal electrical excitability, though they may dwindle somewhat from disuse.

Despite the loss of voluntary control over the muscles upon the paralyzed side, they may yet exhibit *involuntary movements in association* with similar movements upon the healthy side of the body. Thus in laughing, coughing, or sneezing they may contract vigorously, and sometimes reflex movements may be aroused in the paralyzed muscles by tickling or by other forms of excitation.

The *cutaneous reflexes* are sometimes diminished and sometimes remain without change. The *tendinous reflexes* are considerably exaggerated when the pyramidal tracts undergo degeneration. *Trophic changes* are sometimes observed in the paralyzed portions of the body and extremities. *Sensory disturbances* are rarely present, though sometimes the sense of taste suffers in consequence of paralysis of the chorda tympani. The *processes of nutrition* are rarely affected.

The *disappearance of paralytic symptoms* is gradual. In the majority of cases the leg first recovers, and the arm improves at a later period. The opposite course of events is considered an unfavorable occurrence.

Secondary degenerations in the course of the pyramidal tracts are developed when hemorrhage involves the motor zone, or the motor portion of the corona radiata and internal capsule. Its symptoms first appear about six or eight weeks after the occurrence of paralysis. The tendinous reflexes become exaggerated, and gradually the phenomena of contracture are developed in the muscles of the paralyzed limbs. They are most pronounced in the flexor muscles of the fingers, hand,

and forearm, and in the adductor muscles of the upper arm. The extensor muscles of the leg and thigh get the upper hand of their antagonists, so that it becomes necessary for the patient to swing the paralyzed limb forward by a semi-rotary movement of the pelvis.

During the period of secondary degenerative changes, the *psychical functions of the brain* are frequently involved. The intellectual faculties become considerably weakened, and the power of controlling the emotions is greatly diminished.

The *duration of life* after an attack of cerebral hemorrhage may be very short, or it may be prolonged for many years. Relapses are very common, and any one of them may prove fatal, or life may be terminated by progressive debility or by intercurrent diseases.

DIAGNOSIS. The distinction between apoplectic seizures and the *effects of intoxication* with opium or alcohol has already been described. The *apoplectiform seizures* which sometimes accompany cerebral œdema (serous apoplexy) may be distinguished by the absence of permanent paralytic symptoms. The same thing is true of *apoplectiform attacks* that are developed in the course of *multiple cerebro-spinal sclerosis, epilepsy, tabes dorsalis*, and *progressive paresis*. *Apoplectic seizures* from *embolism* or *thrombosis of the cerebral arteries* may be recognized by the concurrence of endocarditis or thrombosis in other parts of the body. Such attacks are usually more common among young people, while genuine cerebral hemorrhage is ordinarily a disease of advanced life, though it may occur at an early period in syphilitic subjects.

PROGNOSIS. The prognosis is always serious, and especially so when the hemorrhage is extensive, or when it approaches the vital centres in the medulla oblongata.

TREATMENT. When a predisposition to cerebral hemorrhage exists, an excessive and exciting diet should be avoided, and the bowels should be kept easily open so as to avoid all violent straining and consequent increase of pressure in the bloodvessels. When an apopletic seizure has occurred, if the pulse be full and strong, with evident congestion of the bloodvessels in the head and face, a copious bleeding should be at once performed, and the patient should be placed with his head elevated by several pillows. Leeches and cups are less effectual, though useful with elderly persons. When the countenance is pale and the pulse is soft and weak, blood should not be taken; it may become necessary to have recourse to the hypodermic injection of camphor, and to ergot, with the application of mustard to the extremities and surface of the body. After the subsidence of acute symptoms and the return of consciousness, the bowels must be kept open by the aid of rhubarb, or the compound infusion of senna with sulphate of magnesium. During the course of the second week it will be proper to commence the administration of iodide of potassium, in five-grain doses three times a day, to facilitate the removal of the products of extravasation. In syphilitic cases mercurial inunctions should also be employed. After the expiration of six or seven weeks, when the symptoms of irritation have disappeared, considerable benefit may be obtained from the employment of weak galvanic currents through the head. The current should be passed between the mastoid processes, or between the sympathetic ganglia be-

low the angle of the jaw and the probable seat of the hemorrhage, for three minutes at a time, and then for an equal length of time in the opposite direction. The strength of the current should never be sufficient to excite pain or dizziness, and the applications may be repeated every other day. Muscular contractions and atrophy may be best relieved by massage. Hot and cold baths are to be avoided, but moderately warm baths are not objectionable.

Embolism and Thrombosis of the Cerebral Arteries.

ETIOLOGY. *Embolic obstruction of the cerebral arteries* is usually caused by valvular diseases involving the left side of the heart. Embolism may result from a previous thrombus in the auricular appendix of the left ventricle, or from other diseases involving the large venous and arterial vessels of the heart. In certain cases the cerebral vessels may be obstructed by embolic masses of fat, derived from fractured bones; and sometimes the excessive production of pigment that follows the destruction of red blood-corpuscles in the course of malarial fever occasions embolic obstruction of the small cerebral vessels.

Cerebral thrombosis is generally a consequence of severe and exhausting diseases that develop a condition of cachexia. It frequently follows endarteritis, as a consequence of old age, or Bright's disease, or syphilis, or chronic alcoholism; and sometimes it results from vascular compression caused by tumors or inflammatory exudations in the neighborhood of the vessels.

PATHOLOGICAL ANATOMY. *Cerebral embolism and thrombosis* most frequently occur in the course of the Sylvian artery or its branches, usually upon the left side of the brain, since the communication is most direct between the heart and the left Sylvian artery. Right hemiplegia and aphasia are common consequences of such an event.

When a portion of the brain is cut off from the direct course of the circulation by obstruction of its vascular supply, if a collateral circulation cannot be established, *necrosis of the tissue or hemorrhagic infarction* are inevitable. For this reason, everything depends upon the seat of obstruction. If it be in the vessels below the circle of Willis, collateral circulation may still provide for the nutrition of the cerebral substance; but if an obstruction be situated in one of the terminal arteries of the brain above the circle of Willis, collateral circulation cannot be established, blood coagulates in the vessels through which it can no longer circulate, and an *infarct* is thus produced; or the tissues undergo *necrotic softening* which may be either white, gray, red, or yellow, according to the amount of pigmentation or fatty degeneration that involves the softened mass. Similar softening follows inflammation of the cerebral substance, but it differs microscopically through the predominance of cellular proliferation and the absence of embolic or thrombotic obstruction in the neighboring vessels.

In *white and gray softening* of the cerebral substance the necrosed tissues can be readily washed out with a stream of water, leaving an irregular cavity in the substance of the brain. *Microscopical examination* indicates fatty degeneration of the nerve fibres and ganglionic

cells. The cellular structures of the neuroglia and of the bloodvessels also undergo fatty degeneration, so that finally nothing remains but minute oil globules and fat-laden cells. As the process advances, the white or gray color of the softening mass becomes transformed into a yellowish tint through the accumulation of the fatty products of degeneration. Sometimes the neighboring connective tissue thickens and forms a cystic envelope, similar to that which surrounds an apoplectic cyst.

Red softening of the brain is a condition which corresponds to the hemorrhagic infarcts that occur in other organs. The color of the softened mass is due to the presence of red blood-corpuscles which gradually break up and are transformed into fatty detritus, while their coloring matter becomes crystallized or deposited in the form of dark-brown or yellow masses. The form of the softened spot is usually oval, and its size varies according to the extent of the territory that has been deprived of its blood supply. Not unfrequently a number of softened masses of different age exist in correspondence with successive embolic or thrombotic occurrences.

When the obstructive plug has been derived *from an infective source*, as in pyæmia or ulcerative endocarditis, or from a gangrenous mass, such as exists in pulmonary gangrene, an inflammatory, suppurative, or gangrenous process is set up in the substance of the brain by the infective micrococci that have thus found access to the organ.

Symptoms and Diagnosis. *Cerebral embolism* usually differs from thrombosis by its sudden occurrence; while the formation of a *thrombus* is more slowly conducted, and is often accompanied by symptoms that resemble the prodromata of an apoplectic seizure. It is impossible to distinguish by the aid of symptoms alone between an apoplectic attack that is caused by cerebral hemorrhage and one that is caused by cerebral vascular obstruction. The subsequent course and symptoms of the disease are identical in both cases. The *probability of embolism* is very great when an apoplectic seizure occurs in a young person who suffers with cardiac disease, especially if previous embolic processes have occurred in other organs of the body. *Thrombosis* may be suspected when arterio-sclerosis exists in the bloodvessels, or when syphilis is present.

Prognosis and Treatment. *Prognosis* and *treatment* are the same as in cases of cerebral hemorrhage, only that venesection should never be performed. Stimulants, rather than sedatives, should be administered to counteract the shock by which the patient is prostrated.

Cerebral Inflammation—Encephalitis.

Etiology. *Inflammation of the brain* is a rare occurrence, and is usually dependent upon injuries of the skull, or upon the extension of inflammation from the ear or other bones of the cranium. It may also result from the entrance of infective embolisms into the cerebral arteries. Such transportation may be effected from the peripheral portions of the body through the right side of the heart, when the foramen ovale remains open. In certain cases encephalitis may be excited by other

diseases within the brain itself; but sometimes the cause of inflammation eludes observation.

Pathological Anatomy. *Encephalitis* may be limited to the production of inflammatory softening, or it may result in the formation of an abscess. *Inflammatory softening* corresponds with that which has been already described as a consequence of embolism or thrombosis. The softened mass may be of a red, brown, or chocolate color. It is swelled by serous effusion, and produces evident bulging of the overlying convolutions and reduction in the depth of the adjacent fissures. As the process advances, the mass assumes a yellowish color, in consequence of the destruction of the extravasated red blood-corpuscles and the transformation of their coloring matter, which becomes stored up in yellow masses within the surviving ganglionic cells. The process of fatty degeneration also adds to the yellowness of the degenerated tissues. The lymph spaces and the white blood-corpuscles become loaded with minute oil globules and crystals of the fatty acids. The softened mass can be readily washed out from the adjacent tissues, leaving an irregular cavity in the substance of the brain. When recovery takes place, the degenerated residuum is gradually absorbed, and a firm, pigmented mass of cicatricial tissue occupies the seat of inflammation. The overlying cortical portion becomes depressed, and the pia mater is thickened and adherent to its surface. Sometimes, instead of cicatricial tissue, a cyst is formed, like that which surrounds an old hemorrhagic extravasation.

Inflammatory softening usually involves only a single circumscribed portion of the brain, but sometimes, as in cases of pyæmia, numerous small inflammatory foci may exist.

Suppurative inflammation of the brain may be either diffuse or circumscribed. *Diffuse suppuration* tends to progressive extension and final perforation through the walls of the ventricles, or through the cerebral cortex into the meningeal cavity.

Circumscribed abscesses are surrounded by a capsule of thickened connective tissue. Their size is extremely variable. Sometimes a circumscribed abscess may become transformed, apparently by rupture of its wall, into a diffuse suppurative process, so that no precise distinction between the two forms of suppuration is possible in such cases. If air finds access to the cavity of the abscess, or if it be dependent upon gangrenous processes in other parts of the body its contents emit an offensive odor. Sometimes the presence of foreign bodies derived from without, or from fractured portions of the cranial bones, may be discovered in the cavity of the abscess. In chronic cases caseation and calcification of the pus may occur; or it may be gradually absorbed and thus cicatrization may occur.

Symptoms. *Cerebral inflammation* frequently exists without manifest symptoms. Sometimes death occurs after a long previous course of emaciation and exhaustion without apparent cause, and only after death is the existence of an abscess revealed. Sometimes the symptoms of *typhoid fever* or of an *intermittent, hectic fever* characterize the course of the disease.

But, in typical cases, general cerebral symptoms of pressure within

the cranium are accompanied by local symptoms of injury to the brain substance. Even then, the diagnosis is often obscure, unless injuries of the cranial bones, diseases of the inner ear, or gangrenous processes in other parts of the body furnish sufficient ground for the suspicion of cerebral inflammation.

Sometimes inflammation is followed by an *apoplectiform seizure* which may result fatally. In many cases the *intellectual faculties* become deranged, and hysterical symptoms may be exeited. Sometimes *convulsive seizures* are witnessed. *Headache* is one of the most common symptoms. It is sometimes accompanied by a sensation as if something were moving in the head. *Dizziness, nausea, vomiting, sleeplessness,* and *irregularity of the pulse* are sometimes experienced. *Pain and perversions of sensation* frequently involve the extremities; and by the aid of the ophthalmoscope *choked disc* or *retinal inflammation* may be discovered, sometimes corresponding to the side upon which the abscess is forming. *Muscular paralysis, spasm,* and *contracture* frequently follow invasion of the motor tract within the brain. Rupture into the ventricles is followed by *convulsions* and *speedy death.* Similar consequences follow the invasion of the meninges. The duration of the disease is usually brief, but sometimes it pursues a very chronic course.

Diagnosis and Prognosis. The recognition of cerebral inflammation is attended with great difficulty, and may be sometimes impossible. The differential diagnosis between *chronic cerebral abscess* and *cerebral tumor* is often attended with great uncertainty. Spontaneous recovery is almost out of the question, and surgical interference is attended with great danger.

Treatment. When cerebral inflammation is suspected, cold applications should be made to the head, and blood may be drawn by the aid of leeches from the vicinity of the disease; the bowels should be kept open, and mercurial inunction should be practised daily, together with the administration of iodide of potassium. For the evacuation of an abscess it is necessary to trephine the bones of the cranium, and to plunge a scalpel into the substance of the brain. This operation will be greatly facilitated when local symptoms indicate the probable seat of suppuration.

Cerebral Tumors—Neoplasmata Cerebri.

Tumors within the cavity of the cranium may originate in the substance of the brain itself, or in the cerebral meninges, or from the bones of the cranium, or they may force their way in from without the cranial cavity. Their growth is sometimes excited by *injuries,* or it may follow *infective diseases,* notably tuberculosis and syphilis. Sometimes they originate as a *secondary growth after malignant disease in distant organs* of the body. They are more frequently observed among men than among women. *Tubercular neoplasms* commonly occur in early life, while *cancerous tumors* are developed during later years.

Pathological Anatomy. According to the frequency of their occurrence may be enumerated the following species of cerebral tumors: Glioma, sarcoma, psammoma, myxoma, carcinoma, melanoma, and cholesteatoma. Other neoplasmic forms are exceedingly rare.

Glioma usually occurs in the white substance of the brain, where it forms a single tumor that contracts no adhesions with the meninges when it reaches the cerebral surface. It is not unfrequently accompanied by hemorrhage, and as it grows it produces symptoms of irritation and of paralysis. When such a tumor undergoes fatty degeneration it may easily be mistaken for yellow softening of the brain. The growth is developed from the neuroglia. Its limits, consequently, are not clearly defined, and intermediate forms exist with the characteristic appearances of myxoma (myxo-glioma).

Sarcoma usually occurs as a primary disease in the brain, though sometimes melano-sarcomatous tumors appear as secondary formations. The disease may spring from the cerebral tissues or from the meninges. The tumor is frequently surrounded by a vascular capsule, and the consistency of the mass is exceedingly variable. Sarcoma grows more rapidly than glioma, and its vascular forms are frequently accompanied by hemorrhage.

Psammoma is usually connected with the dura mater over the convexity of the brain. The mass is chiefly composed of connective tissue in which are imbedded gritty concretions that are composed of calcium carbonate.

Carcinoma usually occurs as a single primary tumor seated upon the dura mater, pia mater, or cerebral tissue. Sometimes the tumor originates outside of the cranium, or it may develop upon the exterior surface of the dura mater and perforate the skull, bulging under the scalp. Medullary cancers are encountered more frequently than the scirrhous form.

Myxoma and *Melanoma* are very rarely observed. *Cholesteatoma* constitutes a solid, pearly-looking mass which may reach the size of a walnut.

Tumors that spring from the bones or from the meninges produce compression of the cerebral substance, displacing its mass, and destroying its function by the exclusion of blood from its vessels, and by atrophy of its tissues. When the base of the brain is involved, the cerebral nerves are liable to disturbance and destruction of their function through the action of similar causes. When a tumor occupies the substance of the brain, it causes progressive bulging of the surface, flattening and dryness of the convolutions, and obliteration of the sulci. Sometimes hemorrhage, inflammation, softening, and anæmia exist in the neighborhood. Meningitis may exist, and dropsy may be developed through pressure upon the venæ Galeni.

SYMPTOMS. *Cerebral tumors* may exist without symptoms when they do not involve the sensory or motor tracts, or produce appreciable increase of pressure within the cranium. The first of the general symptoms that indicate the existence of a tumor is *headache*. This is almost constant, though sometimes intermittent or increased during the nighttime, or by any form of excitement or excess. Its intensity is sometimes beyond description, but in certain cases it exists only as a dull, diffused pain. Sometimes it is localized in a particular portion of the head, though this does not always correspond with the situation of the neoplasm. In certain cases a circumscribed area of tenderness, that

usually corresponds with the situation of the tumor, may be detected by tapping on the bones of the cranium. Vomiting is frequently associated with severe paroxysms of headache.

Dizziness, or vertigo, is commonly observed. Its intensity is variable, and it produces great liability to fall in one direction or another. It is usually most severe when the tumor is situated in the posterior cranial fossa.

Mental derangement is a not uncommon symptom. The patient becomes irritable, moody, hysterical, apathetic, somnolent, delirious, maniacal, or comatose. These symptoms are developed with variable degrees of intensity, and are liable to intermissions and exacerbations. In many cases they are not conspicuous.

Apoplectiform and convulsive seizures are frequently observed, either as a consequence of actual hemorrhage in the neighborhood of a tumor, or by reason of the irritation excited by its presence. *Choreiform movements* are sometimes observed in the extremities when a tumor is situated in the posterior portion of the internal capsule or in the pons Varolii.

Severe peripheral pains of a rheumatic character, and *intolerable itching* are sometimes experienced.

One of the most important symptoms of an intra-cranial tumor consists in the development of *choked disc.* This symptom is observed in nearly every case. It is produced by an increase of intra-cranial pressure that occasions stagnation of the cerebro-spinal fluid between the external and internal sheaths of the optic tract. By this pressure, the retinal veins are hindered from discharging the blood which they contain, and the optic papilla consequently becomes swelled and inflamed, producing atrophy of the optic nerve, and more or less loss of vision. Sometimes retinal hemorrhages are also observed. The symptoms vary in severity, and complete blindness may suddenly occur and disappear, as the amount of pressure temporarily increases or diminishes.

The other *nerves of special sense* are sometimes more or less paralyzed by the increase of intra-cranial pressure, or by inflammation, or by direct compression exerted by the tumor itself.

Excepting cancerous cases, the general health frequently remains without serious modification; but sometimes a *uræmic pallor* is developed. If the floor of the fourth ventricle be disturbed by a tumor, *sugar* usually appears in the urine. *Irregular respiration,* and *retardation of the pulse* are observed during the later stages of the disease, and sometimes *the temperature* is considerably elevated before the termination of life.

Local symptoms are developed according to the situation of a tumor, and according to the function of the nerves or tracts that are specially involved. During the earlier and progressive stages of the disease, the symptoms of *irritation* are most conspicuous; at a later period the symptoms of *paralysis* appear. Irritation is indicated by spasms and contractures; paralysis by weakness and loss of function. When the cranial nerves are subjected to direct pressure upon their nuclei or trunks, the consequent paralytic symptoms are accompanied by muscular atrophy and the reaction of degeneration; both of which conditions are

absent when paralysis is occasioned by pressure involving the tracts between their nuclei and the cerebrum. When the *sensory nerves* are invaded, the phenomenon of *anæsthesia dolorosa* is developed, since the nerve is no longer capable of conveying impressions from the surface of the body, though its irritation at the point of compression occasions subjective sensations of pain that are referred to the periphery.

The *duration of intra-cranial tumors* seldom exceeds two years, though in rare instances a much longer period has been recorded. *Death* usually occurs during a convulsion or an apoplectiform attack, or as a consequence of progressive exhaustion and coma.

DIAGNOSIS. Cerebral tumors must necessarily sometimes escape recognition. The existence of *choked disc* is one of the most valuable indications of an intra-cranial neoplasm. The disease may be frequently mistaken for *cerebral hemorrhage*, *thrombosis*, *embolism*, *abscess*, or *uræmia*. When retinal symptoms are absent, it is sometimes difficult to differentiate the case from ordinary forms of *epilepsy*, *hysteria*, or *mania*.

PROGNOSIS AND TREATMENT. The *prognosis* is unfavorable. Only when a tumor occupies a superficial location in the motor zone of the brain, is it possible to undertake the relief of the patient by surgical methods. In the majority of cases it becomes necessary to remain content with simple dietetic and hygienic measures, relieving pain and vomiting with morphine hypodermically, and giving large doses of potassium bromide during periods of excitement or convulsion. Salicylic acid sometimes is beneficial when headache is severe.

Cerebral Aneurism.

Aneurismal tumors sometimes develop upon the cerebral arteries, and exert pressure upon the adjacent tissues or cranial nerves. They are usually connected with the circle of Willis and its branches, especially with the left Sylvian artery and the basilar artery. In three-fourths of the cases rupture and hemorrhage occur.

The *symptoms* are frequently very obscure, consisting of general disturbances like headache, dizziness, vomiting, neuralgia, loss of vision, spasm, and paralysis in connection with the cerebral nerves. Sometimes the symptoms assume the form of epilepsy, or mental derangement. When rupture takes place, the ordinary symptoms of apoplexy are developed, and frequently terminate in death. In many cases hissing sounds within the head are audible to the patient, and occasionally they may be recognized by auscultation.

Hydrocephalus.

Hydrocephalus consists of a serous transudation either between the meninges (inter-meningeal hydrocephalus), or into the cerebral ventricles (ventricular hydrocephalus). These two conditions may be associated together, since a communication exists between the sub-arachnoid space and the cavity of the ventricles. Occasionally the fluid is restricted within circumscribed limits, by reason of adhesions within the ventricles

or between the meninges; but in the majority of cases the fluid moves freely throughout those spaces. When the disease occurs in early life, while the bones are yet soft and yielding, the cranial cavity may become greatly distended, so that the fontanelles are prominent, and the different bones may be widely separated from each other, even after their sutures had been partially consolidated. But in older patients such distention is seldom possible, and the effects of pressure are manifested by reduction of the thickness of the bones, and by atrophy of the cerebral mass.

The disease may develop very rapidly in an acute form, or it may take a chronic course. It is sometimes originated before birth as a ventricular dropsy, by which the head is enormously distended, so that the substance of the brain forms a mere bladder-like wall surrounding the cavity of the ventricles. Such cases are frequently associated with other congenital malformations and defects. If the infant comes living into the world, life is usually very brief, and is passed in a condition of idiotic helplessness.

In many cases, however, hydrocephalus results from processes that originate after birth. It is very commonly produced by intra-cranial inflammation, especially when that is of tubercular origin, hence the term *acute hydrocephalus*, formerly applied to cases of acute meningitis. *Ventricular hydrocephalus* is frequently dependent upon diseases of the choroid plexus or of the ventricular ependyma. It may be occasioned by compression of the vena magna Galeni, or of the straight sinus, by neoplasms or inflammatory products within the cavity of the cranium; and it may also result from any condition outside of the skull that interferes with the return of blood through the large veins of the neck. In certain cases hydrocephalus depends upon the cachectic and dropsical tendencies that accompany chronic and malignant diseases. It is often associated with rickets; and among old people, in whom cerebral atrophy sometimes occurs, the space left vacant by the dwindling brain is occupied by a hydrocephalic transudation.

Pathological Anatomy. When *hydrocephalus* is developed during infancy, the skull assumes a very characteristic form. The cranial portion is immensely enlarged and contrasts strongly with the pigmy features of the face. The fontanelles are greatly enlarged, and sometimes the bones are completely separated from one another. The roof of the orbit is depressed, and the eye seems unnaturally prominent. The almost hairless scalp is covered with dilated and tortuous veins. Rachitic changes in the bones of the skeleton are frequently evident, and in severe cases the patient lies perfectly helpless and stupid. The brain is compressed, and its anæmic convolutions are flattened in cases of inter-meningeal hydrocephalus; in cases of ventricular distention the sulci are obliterated by the great distention and outward pressure of the fluid in the ventricles, and the basal ganglia are flattened and atrophied. The ventricular ependyma is frequently thickened and granulated. Sometimes the distended hemispheres are actually ruptured. The fluid transudation is usually clear and serous, like ordinary dropsical fluids. It consists of about 99 per cent. of water, with a trace of albumin and other serous constituents.

SYMPTOMS. *Acute hydrocephalus* frequently runs its course so rapidly that the characteristic changes in the form of the skull are not developed; they are most conspicuous in chronic forms of the disease. Besides the evidences of helpless imbecility that exist, spasms, convulsions, and contractures are frequently observed. Complete paralysis is less frequent. When the patient is of an age that does not permit the yielding and separation of the cranial bones, the pressure phenomena of choked disc, optic atrophy, and loss of vision are usually developed. Recovery sometimes takes place, either through the gradual absorption of the liquid, or after its spontaneous discharge through the mouth, nose, orbits, or ears. In many cases, however, death occurs, and may be preceded by convulsions, coma, or apoplectic seizures.

TREATMENT. Infantile hydrocephalus may be treated by puncture and drainage of the cranium, followed by strapping the head with adhesive plaster. Iodide of potassium and other remedies that are supposed to favor absorption exert no appreciable influence. Rickets and other predisposing conditions require appropriate treatment.

Cerebral Hypertrophy—Hypertrophia Cerebri.

Hypertrophy of the brain is usually a congenital condition observed in early childhood. It is frequently associated with rickets; and among adults it occurs in connection with alcoholism, epilepsy, and excessive psychical disturbances. Injuries and other causes have occasionally been blamed for its existence. The condition is usually observed in the hemispheres of the cerebrum, involving an increase of the neuroglia in the white substance. When the skull is opened, the brain bulges as if it had been relieved from excessive pressure. The membranes are anæmic and the cerebro-spinal fluid is deficient in quantity. The consistence of the organ is increased, so that it feels dense, and sometimes is elastic like India-rubber. When the disease develops at an early period, the cranium enlarges and assumes the form of the hydrocephalic skull. In adult cases the bones are excessively thin. The disease is frequently accompanied by an uncertain gait, epileptiform convulsions, headache, dizziness, and vomiting. Sensory disturbances are rare, but irregularity of respiration, retardation of the pulse, muscular contracture, and paralysis are developed as intra-cranial pressure increases. The intellectual faculties finally disappear, and death often occurs quite suddenly. In young children it is sometimes occasioned by spasm of the glottis; and it frequently follows convulsions, apoplectiform seizures, meningeal inflammation, and coma.

Cerebral Atrophy—Atrophia Cerebri.

ETIOLOGY. *Cerebral atrophy* may be congenital, and occurring in children it is frequently unilateral. It is often observed in old age, though by no means a necessary consequence of advancing years. It sometimes results from chronic wasting and malignant diseases, and it may be developed as a consequence of any form of chronic disease within the cranial cavity by which the brain is subjected to pressure.

Secondary atrophy exists in the brain when important organs or members with which it is in connection have been removed, *e. g.*, extirpation of the eyeball, amputation, etc. In like manner it may result from ligature of the carotid artery, or from impaired nutrition by reason of chronic intoxication with opium, alcohol, or lead.

PATHOLOGICAL ANATOMY. When the entire brain is involved in the atrophic process, it shrinks from the cranial walls, and the vacant space is filled by an increase of the cerebro-spinal fluid. The cerebral tissue appears firm and dense, the cortical structures are highly colored, and the white substance assumes a yellowish tint. The neighborhood of the vessels within the hemispheres is riddled with cavities like those in old cheese. The ventricular ependyma is thickened and granulated. In cases of infantile hemiatrophy the cranium becomes unsymmetrical, and the bones upon the atrophied side are increased in thickness. In many cases secondary degeneration follows the pyramidal tracts into the cord and invades the spinal nerve roots, producing spastic symptoms, contracture, or paralysis of various muscles in the extremities.

SYMPTOMS AND DIAGNOSIS. *Infantile hemiatrophy of the brain* is almost invariably associated with physical and mental imperfection. Idiocy is the rule. The muscles of the extremity and of the face upon the side opposite to the atrophied portion of the brain are more or less completely paralyzed and atrophied. The arms are more seriously affected than the legs. The muscles frequently undergo contracture, by which the movements of the limbs are greatly hindered; and the nutrition of the disordered extremities is impaired to such a degree that with advancing years the paretic limbs retain infantile dimensions. The sensory functions seldom exhibit any considerable deterioration, though the special senses are frequently defective. Convulsions are not uncommon, and death is often preceded by coma, or by apoplectiform or epileptiform seizures.

Senile atrophy of the brain is characterized by loss of memory, childishness, tremor, and weakness of the bladder and rectum. Somewhat similar consequences follow the atrophy that develops as a consequence of alcoholism, or cerebral hemorrhage, or any other chronic disease that interferes with the blood supply and nutrition of the brain.

Diffuse Cerebral Sclerosis—Sclerosis Cerebri Diffusa.

Diffuse sclerosis of the brain is produced by a proliferation of the neuroglia, a process that results in atrophy of the nervous elements, and the development of the ordinary symptoms of cerebral atrophy. The affected tissues are elastic, and the disease sometimes invades the spinal cord. It is supposed to be usually dependent upon chronic alcoholism. A positive diagnosis during life is impossible.

Acute Cerebral Infantile Paralysis—Paralysis Infantilis Spastica Cerebri.

This disease occurs among children during the period of first dentition, and is often observed after the ordinary infective diseases. It is probably dependent upon an infective cause.

SYMPTOMS. The disease usually commences suddenly, with fever, vomiting, stupor, and convulsions which are frequently unilateral, and usually involve the right side of the body. After a day or two, *hemiplegic paralysis*, more pronounced in the arm than in the leg, is discovered. Sometimes only one limb is affected. Occasionally the disease takes the form of *paraplegia*, and sometimes the *cranial nerves* are involved. A transient *motor aphasia* often accompanies right-sided hemiplegia, and it is occasionally observed without paralysis of the extremities.

Convalescence is soon established, and the paralytic symptoms become more and more circumscribed, but remain permanent in certain muscular groups. These undergo atrophy, and the paralyzed limbs remain permanently smaller than their fellows, though the development of subcutaneous fat is quite luxuriant. The skin remains blue and cold. Sensation is not changed. The paralyzed muscles soon become rigid, so that it is difficult to bend the joints of the affected limbs. Contractures are developed, and the tendinous reflexes are frequently exaggerated. The electrical excitability of the nerves and muscles remains without change. Hemichorea, hemiathetosis, ataxia, and other unusual forms of motion are often observed. The children frequently remain idiotic or become epileptic, and their convulsive attacks usually commence in the paralyzed limbs.

PATHOLOGICAL ANATOMY. The disease is frequently caused by cortical atrophy, porencephalia, diffuse sclerosis, inflammation, hemorrhage, thrombosis, or embolism—processes that involve the motor zone and paths of voluntary impulse within the brain.

DIAGNOSIS, PROGNOSIS, AND TREATMENT. The disease may be easily distinguised from *acute anterior poliomyelitis* by the presence or increase of the tendinous reflexes, and by the absence of the reaction of degeneration. The prognosis and treatment are the same as that which has been already described in the section on poliomyelitis.

CHAPTER IV.

FUNCTIONAL DISEASES OF THE BRAIN.

Epilepsy—Epilepsia.

ETIOLOGY. *Epilepsy* is a chronic functional disease of the brain, and is characterized by paroxysms of unconsciousness, frequently accompanied by tonic and clonic convulsions. The disease usually begins during the period of childhood and adolescence, but occasionally it commences in advanced life. After the period of maturity its origin is usually dependent upon syphilis or upon cysticerci, or other neoplasms within the cranium.

Epilepsy may be either a *primary disease* of the brain, or it may

occur as a *secondary consequence* of irritative diseases that excite the brain.

Primary epilepsy is, if not an hereditary disease, very commonly encountered among the members of neurotic families whose ancestors have suffered from various forms of nervous disease, or who have been drunkards or insane.

Epilepsy is sometimes originated by *excessive mental or physical excitement*. It sometimes occurs as a consequence of frequent *mimicry* of the disease. *Rickets* and other causes of *constitutional debility* strongly predispose to epilepsy, and it has been frequently observed as a consequence of chronic *alcoholism* or *cocaïnism*.

Secondary epilepsy is often caused by *injuries*, though the primary form of the disease may be developed as a consequence of violent shocks that produce only molecular changes in the brain.

Reflex epilepsy is a variety of the secondary form of the disease that is excited by any cause of peripheral irritation that reaches the brain. In all such cases, however, it is probable that a morbid predisposition already exists in the cerebral structures. Among such cases may be enumerated epilepsies that are excited by pressure upon sensitive scars, or by accumulations of ear-wax, or by diseases and tumors in the nasal and respiratory passages. The alimentary canal is not unfrequently the seat of such irritative agents; and the removal of decayed teeth, undigested food, intestinal parasites, and stagnant feces has been followed, in fortunate cases, by the cure of the disease.

The changes and excitements that accompany *bodily development at the age of puberty* are frequent causes of epilepsy. Phimosis, pregnancy, and other disturbances of the sexual apparatus are not uncommon excitants of the disease. It is not unfrequently aroused by masturbation, and its origin has sometimes dated from the first act of copulation.

In many cases epilepsy is dependent upon injuries, inflammations, tumors, abscesses, etc., involving the cavity of the cranium and its contents. Direct irritation of the cerebral cortex in the motor zone is a common cause of *cortical epilepsy* (Jacksonian epilepsy).

When a predisposition to epileptic seizures exists, the paroxysms of the disease may be frequently excited by the most varied and accidental causes of cerebral agitation.

PATHOLOGICAL ANATOMY. The anatomical conditions by which the existence of epilepsy is determined are unknown. Various pathological conditions have been observed in the brain in connection with epilepsy, but they possess no degree of uniformity, are usually absent, and throw no light upon the nature or causes of the primary form of the disease.

SYMPTOMS. The *symptoms of epilepsy* may vary from a slight and scarcely noticeable disturbance of consciousness to the most violent and terrifying displays of physical and mental excitement and derangement. Two principal forms of the disease are recognized: *the severe* (epilepsia gravis, grand mal), and *the mild form* (epilepsia mitis, petit mal).

The severe form of epilepsy is characterized by the occurrence of convulsions, hence it is frequently termed *convulsive epilepsy*. The paroxysms are usually preceded by disturbance of the emotions—the

patient becomes moody, fretful, sleepless or stuporous, forgetful and apathetic; the pupils are sometimes contracted for several hours before an attack. The paroxysm frequently occurs without special warning, but it is sometimes preceded by peculiar disturbances of sensation or motion, constituting what is termed an *aura*, because it is frequently described as a sensation like that of air blowing upon the body. In many cases a *sensory aura* is characterized by perverted cutaneous sensations—feelings of constriction about the heart, a sense of distension in the abdominal region, unnatural feelings in the sexual apparatus, or a feeling as if something were crawling over the skin of the extremities. These peculiar feelings frequently mount upward from their point of origin until they reach the head, when the paroxysm immediately follows.

Motor auras are usually characterized by slight spasmodic movements, or transient paralysis in the muscles of the extremities or face. *Sensory auras* are manifested in the sphere of special sensation. There may be complaint of some unusual sensation of taste, or smell, or hearing, or of brilliant colors, usually scarlet, flashing before the eyes. Hallucinations are not uncommon; and sometimes there is delirium, during which the patient becomes violent, and commits acts of maniacal fury of which he is utterly ignorant, and which are not remembered after the paroxysm. *Vasomotor auras* consist in the development of circulatory disturbances in the skin—the extremities become pale and cold, or cyanosed, with a feeling of numbness that seems to creep upward toward the vital centres.

The *duration of an aura* is variable. It may be scarcely appreciable, or it may continue for several minutes, giving the patient time to prepare for the threatened paroxysm. In such cases it may be possible to avoid the attack by various measures, such as binding an extremity in which an aura develops, or swallowing a teaspoonful of salt or bromide of potassium. Sometimes, however, it is found that such abortive treatment, like all other forms of treatment that hinder the evolution of the epileptic paroxysm, is productive of so much discomfort that the patient prefers to experience an occasional paroxysm, by which he feels relieved and endowed with a larger amount of comfort.

The epileptic paroxysm is usually ushered in by a frightful outcry that is occasioned, not by pain, but by a sudden tonic spasm of the respiratory muscles. At the same instant consciousness is completely lost, and the patient falls prostrate without the slightest precaution against injury. He may fall into the fire, or into any position of danger, and is thus often subjected to the severest forms of injury, and even to the loss of life. The countenance is deadly pale; sometimes the heart ceases to beat for a few seconds; the eyes are rotated upward beneath the upper lids; every muscle in the body is violently contracted, the head is drawn to one side or the other; the mouth may be either wide open or forcibly closed, with the tongue between the teeth which frightfully lacerate its substance. This condition of *tonic spasm* continues for ten or fifteen seconds. It is then followed by *clonic convulsions*, during which the face becomes flushed, and the whole surface of the body is cyanosed as the eyes roll, the jaws clash, the features

jerk, and the extremities are violently displaced by alternate contraction and relaxation of the muscles. As a consequence of spasms in the muscles of the neck and throat the return of blood to the heart is prevented, and the superficial veins stand out like cords beneath the purple skin. Respiration is impossible; the saliva cannot enter the pharynx, and is expelled between the lips in froth that is frequently tinged with blood. In many cases minute subcutaneous extravasations of blood may be observed upon the forehead, cheeks, and thorax. The fingers and thumb are flexed into the palm of the hand, and if the thumb be forcibly extended it remains drawn spasmodically backward. Urine, feces, and semen are sometimes unconsciously evacuated; the pupils are dilated and no longer react, though the other ocular reflexes are somewhat increased. The temperature remains without special change.

The duration of the clonic convulsion varies from half a minute to five minutes; the skin becomes damp with perspiration; agitation rapidly subsides, and usually the patient remains in a deep sleep or stupor for half an hour or longer. On awakening, there is no recollection of the events that have transpired during the paroxysm, though there may be a sensation of fatigue and muscular soreness, often accompanied by mental torpor, for several days.

In certain cases the convulsive paroxysm is preceded or followed by a *period of delirium or maniacal excitement*, during which the infuriated individual is dangerous to everything and to every person in his vicinity. Under such circumstances homicide and other outrages have been committed without the knowledge of the actor, or any recollection of the event after the cessation of this *post-* or *pre-epileptic stadium* of the paroxysm. In certain cases paralytic symptoms of greater or less severity are manifested for a few days after the paroxysm.

Epileptic paroxysms sometimes occur only during the daytime, but in other cases they are only experienced during the night, usually about three or four o'clock in the morning. Sometimes they thus occur for a considerable period of time, without awakening a suspicion of their existence. The patient complains only of fatigue and muscular soreness during the following day, or he is surprised by finding the bed soiled with involuntary discharges; and only after the tongue has been severely bitten is it finally discovered that he is epileptic. Sometimes the paroxysms occur indiscriminately by day or by night. In certain cases their incidence is very rare, months or even years intervening between the paroxysms. In other cases they occur many times a day. They are sometimes excited by the occurrence of infective diseases, but occasionally they disappear after such an event.

When epileptic paroxysms succeed one another rapidly, at intervals of a few minutes or an hour or two, the temperature begins to rise, grave symptoms of danger are developed, and frequently terminate in death. This condition is termed the *status epilepticus*.

Chronic epilepsy usually produces characteristic changes in the appearance and demeanor of the patient: the expression becomes dull and apathetic, the features are coarse and expressionless, the nose is broad and flat, the lips are thick and sensual, not unfrequently the skull is

unsymmetrical, and the ears are deformed. The mind suffers, memory fails, intellectual development is retarded, and sometimes a condition of permanent idiocy or dementia exists. Though certain historical personages like Cæsar, Mohammed, Charles the Fifth, Peter the Great, and the Emperors Napoleon I. and III., were epileptic, their paroxysms were infrequent, and their intellectual qualities were characterized by unequal development and great defects, as well as by unusual vigor.

The mild form of epilepsy is characterized by brief losses of consciousness (absentia epileptica). In the midst of conversation, or during any other protracted exercise, the patient suddenly becomes pale, ceases to speak or to act, stares vacantly for a few seconds, draws a deep sigh, or yawns, and then everything goes on naturally as before the paroxysm. In certain cases, during the period of unconsciousness, the patient is capable of movement, walks about, runs a short distance, utters profane or indecent ejaculations, or performs some strange and unusual act, to the great surprise of the bystanders, without any consciousness on his part, or any memory of the event after the paroxysm is concluded. Occasionally such a paroxysm is prolonged for many days, during which the patient lives a life of which there is no subsequent recollection, unless during a future attack its memory is revived. Not unfrequently the paroxysm assumes the form of simple vertigo, accompanied by slight and transient stupor. In many cases convulsions never occur, but in others the mild and the severe forms of epilepsy are manifested by the same patient, or one form may be replaced by the other.

The *nature of the molecular changes within the brain* upon which epilepsy is dependent *is unknown*, though the fact of their existence has been rendered unquestionable by experimental research. Vascular spasm and consequent cerebral anæmia have been suggested as the causes of loss of consciousness and of irritation of a hypothetical convulsive centre. Guinea-pigs can be rendered epileptic by rupture of the sciatic nerve, or by hemisection of the spinal cord, or by a blow upon the head. The disease is developed in the course of a few weeks, and its paroxysms may be excited by irritation of a particular spot upon the side of the neck below the ear. The disease thus acquired is transmitted to the offspring. Cortical epilepsy can be excited in dogs by electrical irritation of the cerebral cortex.

Diagnosis. Epilepsy must be distinguished from the *epileptiform convulsions* that accompany many other diseases. *Hystero-epilepsy* is seldom accompanied by complete loss of consciousness; it usually occurs among women, and is characterized by other hysterical symptoms. *Simulated epilepsy* may be recognized by the behavior of the pupils, which are not dilated and react to light; while the thumb when forcibly extended is again flexed into the palm of the hand.

Prognosis. Recovery is rarely observed, though the severity of the disease and the frequency of its paroxysms may be greatly diminished by appropriate treatment.

Treatment. Epileptic mothers should not nurse their infant children, and the health of the growing child should be carefully invigorated by every possible hygienic method. Alcohol, tea, and coffee must be excluded from the diet, and only digestible food should be

allowed. The bowels must be evacuated every day. Moderately warm baths may be frequently enjoyed; and all forms of excess must be avoided. It is always advisable to make a careful search for the existence of causes of peripheral irritation. Phimosis should be removed by circumcision, and parasites of every kind must be mercilessly exterminated. Removal of the ovaries has sometimes been practised, but its consequences are not sufficiently favorable to recommend the operation. When the symptoms of cortical epilepsy clearly point to a definite lesion in the motor zone, the skull should be trephined, for the purpose of exploration and removal of any accessible cause of irritation. Peripheral scars should also be incised, if they be sensitive and evidently connected with the occurrence of the epileptic paroxysm. Tubercular tendencies and diseases are benefited by the use of cod-liver oil. Anæmic patients should have iron and restoratives. Other constitutional diseases require appropriate treatment.

Remedies innumerable have from time immemorial been prescribed for the relief of epilepsy. Almost every physician possesses some favorite specific which he considers particularly useful for the cure of the disease. Valerian, belladonna, nitrate of silver, and all the metals have been prescribed without any notable degree of success. The bromides alone possess any considerable or enduring virtue in the treatment of epilepsy. By many physicians a mixture of the different bromides is recommended, but the bromide of potassium is, of them all, the most efficient. It has the disadvantage of producing acne, or, if given in excess, of exciting maniacal symptoms or a condition of great prostration. Such abuse of the drug should never be practised. Under ordinary circumstances, bromide of sodium may be administered with more satisfactory results. It should be given in doses of fifteen grains and upward four times each day; the last dose should be doubled and administered at bedtime. When combined with moderate doses of chloral hydrate a smaller quantity of the bromide is frequently sufficient, but this drug should not be administered for any length of time; the bromides alone may be safely exhibited for many years. When epileptic paroxysms are preceded by an aura of sufficient duration, they may be frequently averted by the inhalation of amyl nitrite. The same remedy may be employed with advantage during the *status epilepticus*.

Eclampsia.

ETIOLOGY. The term *eclampsia* is employed to signify those epileptiform paroxysms which occur as a consequence of irritation of the motor zone in the cerebral cortex. Such excitement is produced by uræmia, by lead poisoning, and by various diseases involving the meninges and the cerebral cortex. It may occur during the course of pregnancy; and it is a frequent incident among infants whose cerebral mechanism is still imperfectly developed, and who are consequently easily excited by all forms of peripheral irritation. It is not uncommon in such cases, during the course of infective diseases, and rickets, or whenever a feverish condition occurs, or when under the influence of violent mental excitement and emotion.

SYMPTOMS. The symptoms of an *eclamptic attack* correspond, in every respect, with those which are developed during a paroxysm of epilepsy. In young children they are frequently preceded by the occurrence of restlessness, indigestion, and unquiet slumber during which the little patient laughs, moves uneasily, grinds his teeth, or wets his bed. The paroxysms are sometimes frequently repeated, developing a condition identical with the *status epilepticus*, and a fatal termination is not uncommon.

TREATMENT. The general health of the patient should be carefully invigorated, and all causes of peripheral excitement and disease must be removed, so far as possible. During the occurrence of a paroxysm the child may be placed in a warm bath, while its head is cooled with cold water; and the bowels should be relieved by an injection, or by a cathartic dose of calomel. Mustard plasters and other irritants are useless, excepting in cases of great prostration. During the status epilepticus it may be necessary to resort to inhalations of amyl nitrite or chloroform. The bromides may be used after the paroxysm, as in cases of epilepsy.

St. Vitus' Dance—Chorea.

ETIOLOGY. *Chorea* is a frequent disease in early life, occurring during the period of second dentition, or about the age of puberty, or during early adult life. Among females it is twice as frequent as among males. It is usually observed among *delicate, nervous children*, who belong to neurotic and consumptive families. The *predisposition may also be acquired* by excessive mental activity, accompanied by deficient nutrition, or any other cause of physical exhaustion or mental depression. The direct manifestation of the disease is frequently excited by *violent emotions*, by *injuries*, or by the presence of *intestinal parasites* or other causes of peripheral irritation. For the same reason it sometimes is developed during the course of *pregnancy*, usually during the period when the patient is subject to morning sickness and other evidences of nervous disturbance. It generally ceases after evacuation of the uterus, but it is not unfrequently fatal under such circumstances.

Cardiac diseases are frequently associated with chorea, though it is doubtful whether they sustain the relation of cause and effect. In like manner *infective diseases* and *rheumatism* are sometimes followed by chorea.

The disease is occasionally observed as a consequence of mimicry on the part of sportive companions who find themselves at last afflicted by the disease which they so successfully imitated. The disease is most frequently encountered during the cold and chilly months of the year, it sometimes appears to occur almost epidemically.

SYMPTOMS. Chorea frequently commences suddenly, but it is often preceded by a considerable period of general depression and disorder of the health. At length the *irregular and involuntary movements* of the extremities begin to attract attention; the arms are in almost constant motion, pronation and supination rapidly succeed each other. The fingers are alternately flexed and extended, the shoulders are shrugged,

the head is irregularly twitched in various directions, the features are distorted by involuntary grimaces, respiration is often jerky and snuffling; what has been happily termed a universal muscular delirium is developed. The condition is frequently aggravated by mental excitement; sometimes, however, the reverse is apparent. During sleep the disorderly movements of the muscles are arrested, but they are renewed immediately after waking. In severe cases it becomes impossible for the patient to walk or to use his hands or to sit up. He must remain in bed, and unless care is taken he will often find himself upon the floor, and the skin may be excoriated by incessant friction.

In such cases a hammock is often the best place for the comfort of the sufferer.

In certain cases the choreic movements are restricted to one side (hemi-chorea), or they may involve a single limb. The left half of the body is most liable to the disease.

Sensory disturbances are usually absent, though sometimes *painful points* exist over the spinous processes, or in the course of the peripheral nerves. The *electrical excitability of the nerves* is usually unchanged, and the *internal viscera* remain unaffected. *Pallor and emaciation* are common events, and the *mental faculties* exhibit notable weakness. The patient appears silly, dull, forgetful, and irritable. Occasionally *permanent mental derangement* is experienced. *The pulse* is usually enfeebled, but the bodily *temperature* remains without change in uncomplicated cases.

Chorea is sometimes complicated by painful *swelling of the joints* and by *rheumatism* and *cardiac diseases*. Various evidences of *muscular weakness* and *hysterical disturbance* are often observed.

PATHOLOGICAL ANATOMY. Chorea is a purely functional disease. The anatomical changes that have been sometimes described are quite accidental, and have no causal relation with the symptoms.

DIAGNOSIS. Choreic movements are sometimes caused by *irritation of the motor zone in the brain*, as a consequence of inflammation, hemorrhage, softening, tuberculous tumors, or parasites. In all such cases the disease may be differentiated from chorea by the presence of other severe symptoms of local disease in the brain. *Hysteria* is sometimes accompanied by hallucinations, disturbances of consciousness, and choreic movements. *Tremor* and *paralysis agitans* are distinguished by the regularity and moderation of the tremulous excursions. *Multiple cerebro-spinal sclerosis* exhibits muscular agitation only during voluntary movements. *Athetosis* is characterized by regular and persistent movements associated with other evidences of organic lesion. *Post-hemiplegic chorea* is only observed in the paralyzed extremities after cerebral hemorrhage.

PROGNOSIS. The duration of the disease varies from one to three months. Its course is sometimes arrested by intercurrent diseases, but it is frequently renewed after their termination. The prognosis is usually favorable, especially among children, though the occurrence of obstinate sleeplessness is an element of serious danger.

TREATMENT. In the treatment of chorea it is desirable to eliminate every cause of peripheral irritation; especially should the alimen-

tary canal be carefully evacuated, and search be made for intestinal worms. Any specific or special disease must receive appropriate treatment. A warm bath every morning and evening is of considerable service. The galvanic current should be employed; and if painful points can be discovered along the spinous processes or over the trunks of the peripheral nerves, the anode should be applied over them. For internal medication, Fowler's solution of arsenic may be given three times a day, commencing with three drops, and increasing the dose one drop each day until it reaches ten drops or more. Still better results may be obtained from the daily hypodermic injection of a single full dose of the solution. During the later stages of the disease benefit is sometimes derived from the use of strychnine; and in very obstinate cases zinc sulphate may be given three times a day, commencing with one grain after each meal, and increasing by one grain each day until ten or twelve grains are taken at a time. In cases of sleeplessness it is necessary to administer chloral hydrate and alcoholic stimulants until sleep is procured.

A form of chorea is sometimes observed *among patients in middle life, occurring generation after generation* among many members of the same family (hereditary chorea). The disease commences gradually, and extends until all parts of the body and extremities are involved. The bladder and rectum remain undisturbed, sensation is not affected, and the electrical reactions of the muscles are unchanged. After a time mental disturbance is observed, and suicidal inclinations are sometimes manifested. As the mind fails the body wastes, and finally death results from exhaustion or from intercurrent disease.

The terms **præ- and post-hemiplegic chorea** signify a form of chorea that is associated with hemiplegia as a consequence of cerebral hemorrhage or other cerebral disease. The *præ-hemiplegic form* of the disease usually commences several days before the apoplectic attack by which hemiplegia is produced, and the movements cease with the occurrence of paralysis. The *post-hemiplegic form* of chorea, on the contrary, develops after the occurrence of paralysis, is frequently associated with muscular contracture in the paralyzed limbs, and continues usually through life. Sometimes the paralyzed side is also anæsthetic, a fact that points to the posterior and middle portion of the internal capsule as the seat of the disease.

Athetosis.

Athetosis is a symptom that is sometimes observed in cases of hemiplegia, though it sometimes exists without paralysis in connection with epilepsy, idiocy, various forms of insanity, and other cerebral diseases. The fingers and toes manifest slow and irregular movements of flexion, extension, adduction, and abduction. (Fig. 168.) These movements are diminished, but do not entirely cease, during sleep. Muscular contraction is sometimes present. Electrical reactions are unchanged. It is often possible to produce temporary suppression of the muscular movements by firmly grasping the wrist or the ankle with the other hand, or by elevating the affected limb; contractures then yield, and

FIG. 168.



Athetosis. (CHURCH.)

the movements cease, but are immediately renewed when pressure is removed. In certain cases the disease is undoubtedly identical with post-hemiplegic chorea.

Shaking Palsy—Paralysis Agitans.

Paralysis agitans is a disease of old age, characterized by muscular weakness and stiffness associated with a peculiar position of the body, and rigidity of the features, sometimes accompanied by compulsory movements, and almost always attended by tremor.

SYMPTOMS. *Paralysis agitans* sometimes begins suddenly, but is often gradually developed. The first characteristic symptom is presented by *tremor*, involving the muscles of the fingers, and extending up the arm and to the lower limb; the opposite arm is then invaded, and finally the lower extremity on that side. Sometimes, however, the disease remains for a long time in one limb, or upon one side of the body. The muscles of the head and face are seldom affected. These tremors continue when the limbs are perfectly supported, and they either diminish or are not increased during voluntary movements. Mental agitation causes them to increase. They at first subside during sleep, but finally they persist at all times. The character of the tremor varies considerably. In the majority of cases the muscular excursions are but little greater than those which are observed as a consequence of alcoholism; but not unfrequently they increase, and sometimes reach a very considerable magnitude, so that the chair upon which the patient sits, or the bed upon which he lies, is violently shaken by the muscular agitation. In certain cases, however, muscular tremor is entirely absent, and the disease can be recognized only by the peculiar *stiffness*

limbs and spine, the *stolid rigidity of the features*, and other cteristic symptoms of the disease.

ll more valuable as a diagnostic symptom is the *peculiar attitude* patient and the position of his extrem- the extensor muscles become enfeebled, the flexor muscles are rigid and slightly acted. (Fig. 169.) The patient stands in ping position, with the head projecting rd, the knees and hips slightly flexed, rearms flexed and pronated, the hands ly flexed at the wrists, while the fingers humbs are placed in apposition as if g a pen, or as if rolling a bullet en their tips. In certain cases the tors of the thighs draw the limbs so together that ulceration upon the inner e of the knees is produced by their n. In the act of walking the feet fre- ly assume the varus-equinus position, he toes are flexed like the thumb and s. In certain cases the act of walking es difficult or impossible, in conse- e of violent *propulsive movements* in rward direction. If walking be possi- nder such circumstances, the patient long as if about to fall forward. Occa- ly a *retropulsive movement* is observed, t each step the head and shoulders are forcibly backward. Sometimes in the stages of the disease natural locomotion es impossible and the patient can only by plunging forward after being pro- placed with his face in the direction of d or couch toward which he must make ay.

Fig. 169.



Paralysis agitans. (Rush Medical College Clinic.)

e *temperature* of the tremulous limbs etimes elevated; the *electrical reactions of the muscles and nerves*, he *sensibility of the skin* remain without notable change; the *nous reflexes* are sometimes increased, and *painful pressure-* are not uncommon upon the head, vertebral processes, and heral nerves.

markably characteristic is the *expression of the countenance*, preserves a stern and solemn rigidity under all circumstances. *h* loses its expressive tones—becomes monotonous, and even stut-, when the muscles of articulation share in the universal tremor; ps usually remain partially open, and saliva often trickles from rners of the mouth. *Perspiration* is often increased, especially g the night-time; and though the temperature of the body seldom there is great complaint of heat accompanied by a disposition ow off the bed-clothing. The uneasy sufferer cannot remain long

in one position, but must be frequently moved, and groans with distress if his requests are unheeded.

The *mind usually remains unaffected*, though in certain cases the termination of the disease is heralded by increasing apathy that may result in *dementia*. Under such circumstances the bladder and rectum may share in the approaching collapse. Like other chronic diseases of the central nervous organs, paralysis agitans is sometimes accompanied by *apoplectiform seizures* for which no anatomical basis can be discovered.

The *duration of the disease* covers many years, sometimes lasting for more than a third of a century.

ETIOLOGY AND PATHOLOGICAL ANATOMY. Nothing is known regarding the nature and anatomical causes of paralysis agitans. The anatomical changes that have been sometimes observed are merely those which indicate senile degeneration, or are of accidental occurrence.

The *exciting causes* of the disease are generally the same that underlie the majority of nervous diseases. Cold and injury, violent mental excitement, infective diseases, alcoholism, gout, debauchery, care, and worry, together with the hereditary influences that operate in neurotic families, are the usual causes of paralysis agitans.

DIAGNOSIS. Paralysis agitans must be differentiated from *simple tremor* by the more extensive character of the muscular oscillations, and by the fact that ordinary tremor may be usually referred to old age or intoxication with alcohol, mercury, or lead. *Multiple cerebro-spinal sclerosis* differs by the fact that its muscular oscillations are manifested only during voluntary movements, and are accompanied by nystagmus and scanning speech. *Chorea* is characterized by the wider extent and greater irregularity of the muscular excursions.

PROGNOSIS AND TREATMENT. The disease, though incurable, is not particularly dangerous to life. Its symptoms may be often temporarily relieved by the administration of hyoscyamine (grain $\frac{1}{200}$ three times a day). The best results are obtained from the hypodermic injection of Fowler's solution of arsenic, of which from five to ten drops may be given each day. Other remedies have been employed, but nothing affords anything better than temporary relief.

Tremor.

SYMPTOMS. *Tremor* consists of rapidly successive brief muscular contractions, by which individual muscles, groups of muscles, or the entire locomotive apparatus are maintained in a state of oscillation. In the majority of cases the fingers and hand are first and principally involved. It may extend to other parts of the body, invading this or that muscular group, though the muscles of the eyes are rarely affected. Agitation ceases during sleep, and it may be diminished when the limbs are efficiently supported, or when a strong voluntary effort is exerted for its suppression. In certain cases it is increased by voluntary movements.

ETIOLOGY. *Tremor* may be produced by violent emotion, by exces-

sive muscular exertion, by the inordinate use of alcohol, opium, tea, coffee, and tobacco, or by poisoning with mercury, lead, and other metals. The symptom is frequently observed in connection with many forms of debility which are developed among nervous and anæmic persons, especially when they have been exhausted by debauchery, prolonged lactation, or chronic wasting discharges. The symptom frequently occurs in extreme old age, and it is a common accompaniment of exophthalmic goitre.

The anatomical basis of functional tremor is unknown. It undoubtedly is of a character that interferes with the efficient efflux of tonic impulses from the brain and spinal cord to the muscles; but the nature of the molecular changes by which this is conditioned is unknown.

TREATMENT. Tremor often resists all therapeutic measures. So far as its exciting causes can be discovered, they should be removed. Good diet, restoratives, and tonics, together with change of air and occupation, afford great relief. The judicious use of electricity and massage is very beneficial. Fowler's solution of arsenic, hypodermically, is an admirable restorative; and temporary relief may be obtained from hyoscyamine (grain $\frac{1}{200}$ three times a day). Valerian, strychnine, iron, quinine, and zinc phosphide are often beneficial.

Vertigo.

Vertigo is a symptom that is frequently associated with other functional disturbances of the brain. It is sometimes experienced during the daytime; in other cases only during disturbed and interrupted sleep in the night-time. Sudden change of position is frequently followed by a brief paroxysm of dizziness, and it often is associated with various disordered conditions of the stomach. Sometimes the patient seems to whirl around, while in other cases external objects appear to be in a state of revolution. These subjective movements may be either horizontal or vertical.

Vertigo is occasioned by a *disturbance of the sense of bodily equilibrium*. This is frequently produced by different diseases involving various portions of the *brain*, and it is very commonly dependent upon a disordered condition of the different *organs of special sense*. Among old people it is frequently observed as a consequence of a diseased condition of the *cerebral vessels*, involving disorders in the vascular supply of the brain. The symptom, though by no means universally dependent upon the condition of the cerebellum, often occurs in an aggravated form when the different *organs in the posterior fossa of the cranium* are diseased.

Vertigo is frequently occasioned by *intestinal parasites*, by *chronic constipation*, and by *indigestion*. It is sometimes observed at the time of *menstruation*, and in connection with the *menopause*. It may be associated with *cardiac diseases and disorders of the blood* that interfere with the cerebral circulation. The effect of *alcohol* and other narcotics in the production of vertigo is a matter of common observation. *Paralysis of the muscles of the eyes* is sometimes followed by vertigo dependent upon the defective coördination of the visual impressions by

which the sense of equilibrium is sustained. A notable form of vertigo is excited by *diseases of the inner ear*, or by the accumulation of wax upon the tympanum. When the *labyrinth and semicircular canals* are involved, vertigo occurs in connection with deafness and noises in the head (Menière's disease).

A symptom that is dependent upon so many and so widely different causes obviously cannot be subjected to any uniform method of treatment. Its cause must be ascertained and removed before a successful result can be reached.

Catalepsy—Catalepsia.

Catalepsy is an occasional symptom that may be observed in connection with other functional disorders of the brain, viz.: hysteria, chorea, insanity, and intoxication with ether or chloroform. It sometimes occurs in the course of typhoid or intermittent fever, or as a symptom of inflammation in the brain or its membranes. Associated with the phenomena of *ecstasy* and *trance* it has been frequently observed during periods of great emotional excitement.

Catalepsy is characterized by paroxysms of *muscular rigidity* during which the limbs remain in any position that they have previously assumed, or in which they have been artificially placed. The muscles

FIG. 170



Catalepsy. (RUSH MEDICAL COLLEGE CLINIC.)

are not spasmodically contracted, and the joints can be readily flexed during passive movements, constituting what has been termed *waxy flexibility*. The patient is sometimes suddenly arrested during the act of voluntary movement, and the limbs retain their position, even though the attitude be constrained and unnatural, for a period of time varying from a few minutes to many hours or days. During this period con-

sciousness may be more or less involved or completely suppressed; the stiffened limbs can be easily displaced, but retain their novel positions like the arms and legs of a jointed doll. (Fig. 170.) The *electrical irritability of the muscles* is somewhat increased. Those muscles of the body which are not under the control of the will do not exhibit any change of function—if food be introduced into the pharynx it is swallowed; *the reflexes* are diminished, and, in severe cases, may disappear. The surface of the body becomes pale, and its temperature falls.

In protracted cases there is danger of starvation, unless artificial feeding is enforced.

The disease may be readily differentiated from *simulated muscular rigidity* by the graphic method. In genuine cases the sphygmograph when applied to the muscles registers a straight line, but when applied to the muscles of a simulator the line is broken by rapidly successive and extensive oscillatory movements.

The *treatment* of catalepsy must be directed to the underlying disease or general conditions with which it is associated.

Hysteria.

Hysteria is a functional disease of the brain for which no apparent anatomical basis can be discovered. Hysterical symptoms, however, are frequently observed in association with numerous and widely differing diseases, consequently they will vary according to the sphere in which they are manifested.

Hysteria is more frequently observed among women, but it is not an uncommon occurrence in the masculine sex. Certain races are predisposed to its manifestation, notably the Celtic and Asiatic races. It is usually experienced during the ten or fifteen years that follow the development of puberty, but magnificent examples of the disorder are not uncommon among young children and among women in middle life, or even later. It usually is developed in neurotic families in which for many generations nervous disorders have been common; such hereditary influences are most frequently transmitted through the maternal line. The tendency frequently exists, however, not as a consequence of hereditary transmission, but as a result of congenital influences; a fact that may be frequently recognized in consumptive families, or under the influence of other causes of debility among the parents of the future hysterical sufferer. Such a disposition may be still further aggravated by faulty education and by erroneous habits of life; over-education, insufficient bodily exercise, emotional excitement, premature participation in the sights and experiences of city life, late hours, improper reading, and all forms of unnatural and unhealthy association, favor the development of hysterical symptoms. In such patients may be observed a fondess for emotional excitement and self-indulgence, without cultivation of the power of self-control and self-denial. Slight physical disorders, fatigue, and emotional depression find in such individuals a sphere for the ready development of the most varied forms of hysteria.

Though by no means always dependent, as its name would imply,

upon uterine diseases, hysteria is, nevertheless, a not uncommon consequence of excitement of the sexual apparatus; especially when such disease takes the form of slight and irritative disorders. The graver forms of disease are less frequently accompanied by hysterical symptoms. It is frequently a consequence of unsatisfied sexual appetite among the consorts of impotent men.

Hysteria sometimes results in apparently healthy persons as a consequence of the terror and astonishment to which they have been subjected on witnessing an hysterical paroxysm. For this reason the disease sometimes appears in the form of a local epidemic in boarding schools, nunneries, and other societies of young people.

SYMPTOMS. Among the *motor disorders produced by hysteria* may be mentioned *paralysis*. This may involve single nerves, muscular groups, an entire extremity, or the whole body. Hysterical hemiplegia is frequently accompanied by hemianæsthesia upon the same side, often involving the entire half of the head and body, though the limbs alone be involved in the paralysis. Such disturbances are frequently connected with other conspicuous symptoms of hysteria; they may persist for a variable period of time, and may be finally terminated by a very sudden and unexpected recovery. The left side of the body is affected more frequently than the right, and the arm more frequently than the leg. Muscular atrophy and change of the electrical reactions are not often observed, though the muscles often are weakened from disuse. The muscles of the face and eyes seldom experience paralysis, excepting the upper lid, which not uncommonly droops (ptosis hysterica). Sometimes the muscles of deglutition are affected so that artificial feeding becomes necessary. Laryngeal paralysis is often experienced, and sometimes is followed by speedy recovery after the use of the tongue spatula, or after the application of electricity or some other unexpected form of excitation.

In many cases hysterical *contractures of the muscles* may be observed in the limbs. They frequently follow the occurrence of an hysterical paroxysm, but are sometimes excited by trifling injuries. The arms are usually contractured in the position of flexion, while the lower extremities remain extended. Such contractures do not disappear during sleep, though they may be relaxed under the influence of chloroform. The muscles become dwindled through disuse, and the joints are deformed by chronic displacement of the affected limbs. In certain cases the *tendinous reflexes* are increased, and it is then probable that the lateral columns of the cord are sclerosed. Under unusual excitement such contractures and deformities may temporarily disappear, but they are liable to be reproduced after the subsidence of mental agitation. In many cases slight muscular tremor may be observed like that which exists under ordinary conditions of debility.

Hysterical convulsions of a tonic or clonic character are not uncommon. Local spasms, such as affect the muscles of the face, are frequently due to hysteria, and universal convulsions are often excited by comparatively trifling causes. They differ only from the convulsions of epilepsy by the preservation of consciousness and a certain amount of self-control that protects the patient against injury. Unlike the

epileptic, the hysterical patient invariably chooses a comparatively safe and comfortable spot for the manifestation of convulsive phenomena. In certain cases, however, the symptoms assume great severity, and are protracted for a considerable period of time, constituting the so-called *hystero-epileptic paroxysm.* The attack is preceded by an aura constituted by sensations as if something were moving in the stomach, or as if a ball were rising in the throat (œsophageal peristalsis). The patient appears delirious, experiences hallucinations and convulsions, during which consciousness may be completely abolished. These are followed by opisthotonus, by manifold twisting and wriggling of the body, accompanied by cataleptic positions, or rigidity of the limbs. These manifestations are succeeded by various attitudes and grimaces expressive of erotic or other emotion. Finally the paroxysm terminates more or less suddenly, and the patient recovers consciousness, but professes complete ignorance of what has occurred. In certain cases hysterical paroxysms may be excited by pressure upon certain sensitive spots that exist, apparently at random, upon different portions of the surface. Sometimes an attack may be speedily terminated by pressure upon these sensitive zones, one of which frequently exists a little above Poupart's ligament. This has been frequently referred to a sensitive condition of the neighboring ovary, but certainly, in the majority of cases, all the adjacent tissues and organs participate in the condition of hyperæsthesia.

Hystero-epilepsy is rarely attended with danger, but sometimes the *status epilepticus* is established, the temperature rises inordinately, and death occurs.

In certain cases violent *paroxysms of crying* or of *laughter* occur, and *cataleptic seizures* are occasionally witnessed.

Hysterical disturbances of sensation may exist, either in the form of exaltation (hyperæsthesia), depression (anæsthesia), or perversion (paræsthesia). Anæsthesia usually involves the back of the hand or the foot. It may occur in irregular patches which have no special relation with any particular nerve, or it may involve a whole extremity, or the entire body. Sometimes only particular forms of sensibility are affected, but frequently all the tissues are involved, and the skin may be wounded or punctured without any evidence of pain. The application of metallic plates or other irritants to the skin is sometimes followed by the transfer of anæsthesia to the opposite side of the body, or by its complete disappearance.

Hysterical neuralgia is frequently experienced; many cases of coccygodynia and of irritable breast are due to this cause. Headache, and painful points upon the scalp (clavus hystericus), upon the spinous processes, joints, and other localities are not uncommon.

Vasomotor and secretory disturbances are sometimes manifested in the form of subcutaneous hemorrhages, or bleeding from the mucous membranes. Sometimes the tissues are rendered bloodless by a vasomotor spasm, so that deep punctures are not followed by the appearance of blood. Copious and irregular perspiration is sometimes witnessed.

The organ of vision is frequently disturbed by neuralgic pains in its vicinity, and by slight muscular spasms or contractures; while the

functions of the retina may be either exalted, depressed, or temporarily abolished. Light may be so intolerable that the patient must remain continually in a darkened room; or the eye may be exposed to a brilliant illumination without perception of light. Visual hallucinations are frequent. Similar disturbances sometimes involve *the organ of hearing*, as well as *the other special senses*. The patient may experience the most astonishing exaltation of these senses, or they may be temporarily abolished, or utterly perverted, so that disagreeable objects of sense become agreeable, and *vice versâ*. *Unnatural craving for inedible or undigestible articles*, like chalk, slate pencils, etc., is sometimes manifested. A not uncommon symptom consists in the *accumulation of air that has been swallowed* in the stomach, from which cavity it is subsequently eructated. Uncomfortable *borborygmi* are frequently experienced. Obstinate and uncontrollable *vomiting* frequently occurs, and sometimes the entire *abdomen is enormously distended* and excessively sensitive (tympanites hysterica). Such cases have been mistaken for genuine peritonitis, but they may be recognized by the absence of fever and by a great relief through deep pressure, or after an injection of assafœtida. *Vomiting of blood*, which sometimes occurs, may be a purely hysterical phenomenon, though search for the symptoms of gastric ulcer should always be carefully instituted in such cases. Sometimes *vasomotor and secretory disturbances* in the abdomen are indicated by pulsation of the abdominal aorta, and by paroxysms of watery diarrhœa.

Respiratory disturbance often takes the form of laryngeal spasm, or an asthmatic paroxysm, or a constant convulsive cough. Vicarious *hemorrhages* from the lungs indicate vasomotor disturbance. A peculiar *anæsthesia of the fauces* frequently exists, or it may be replaced by the opposite condition. *Diaphragmatic spasm* produces a violent hic cough. *Cardiac palpitation and neuralgia* may frequently occur. *The pulse* is exceedingly variable, in correspondence with conditions of spasm or of paresis in the vascular walls.

The condition of *the urine* exhibits great variation. Sometimes it is clear, watery, and copious, with low specific gravity. This is especially common after an hysterical paroxysm. In other cases the secretion of urine may be almost totally suppressed for days and weeks together, while urinous liquids are vomited from the stomach. In certain cases there is manifested a constant desire to urinate, while in others there is complete paralysis, necessitating the use of the catheter. In *the uterine organs* neuralgia may exist as an indication of hyperæsthesia, which may be accompanied by spasmodic conditions of the muscular apparatus, constituting *vaginismus*. Menstrual disorders are not uncommon. Sometimes there is complete loss of sensibility in the vagina with total abolition of sexual appetite or sensation. The occurrence of pregnancy is often the occasion for the development of innumerable nervous disturbances.

The *appetites and emotions* in like manner exhibit various alternating disturbances through exaltation of their normal function. Intolerable thirst and voracious hunger may be succeeded by absolute loathing of

food and drink. In certain cases anomalous paroxysms of fever with incredible elevation of temperature have been observed.

The moral and intellectual faculties frequently exhibit astonishing perversion. Self-consciousness and selfishness are greatly exalted, and the patient displays wonderful ingenuity in the devices by which she seeks to attract attention and to awaken sympathy. All sorts of diseases are simulated. Sometimes the patient learns to compress the bulb of the fever-thermometer, so as to give occasion for the impression that she is suffering with an intense fever, and sometimes she seeks to increase the deception by artificial acceleration of the respiration and of the pulse. Attempts at suicide are sometimes ostentatiously undertaken, but rarely attain to complete success. Uncontrollable fits of laughter and crying indicate the excitable condition of the emotional nature; and sometimes it is impossible to draw the line between the manifestations of hysteria and of genuine insanity.

Manifold *disorders of sleep* are sometimes exhibited, in the form of somnambulism, ecstasy or trance. Sometimes the patient remains for months in a condition of stupor. In certain cases profound syncope may counterfeit the appearance of death itself.

Loss of speech sometimes occurs, and the patient remains for weeks unable to utter an audible sound. The voice may be suddenly restored under the influence of sudden emotion or excitement.

Hysteria is usually a chronic disease, and though interrupted by many remissions, and rarely fatal, it is usually a source of great misery through life.

TREATMENT. The children of neurotic families, among whom a predisposition to hysteria may be reasonably anticipated, should be subjected to the most careful physical, mental, and moral training, so as to invigorate their bodies and to increase their power of self-control and consideration for others. Removal of the ovaries has been frequently practised for the relief of hysterical symptoms, but the operation should never be performed unless the organs give unmistakable evidence of organic disease. Many cases are much benefited by abundant diet and massage, according to the rules adopted by Weir Mitchell. Hypnotism has been sometimes employed with temporary success. Conditions of excitement may be greatly tranquillized by long-continued warm baths. Electricity is frequently useful, especially in paralytic conditions, and when the muscles are in a state of contracture. The faradic brush is recommended in the treatment of anæsthetic conditions. Change of air and all forms of out-door life are desirable. Numerous remedies have been prescribed for internal use, but few of them effect any special modification of the disease. Anæmia and local diseases accompanied by hysterical symptoms, of course, require appropriate treatment, but simple uncomplicated hysteria is usually uncontrollable by pharmacy.

Neurasthenia.

Neurasthenia is a condition of exhaustion which may be dependent upon functional weakness of the brain, of the spinal cord, of the vasomotor nerves, or of the various ganglia and nerves that preside over the

functions of the different viscera. The disease is most frequently encountered among slightly built and nervous persons, who have been inordinately overtaxed in the struggle for position and wealth in the highly organized and complicated development of modern society. The disease, like other nervous disorders, usually occurs among the members of neurotic families, especially among the children of debilitated parents. When on the basis of such hereditary predisposition a delicately organized youth launches at an early age upon the sea of excitement in a large city, and stimulates his appetites and passions in every possible way by the use of tea, coffee, tobacco, alcohol, and other narcotics, early disaster becomes inevitable.

SYMPTOMS. *Cerebral neurasthenia* is indicated by the symptoms of cerebral exhaustion. The spirits are depressed and easily excited, headache and insomnia frequently occur, or there may be an unusual disposition to sleep. Mental exertion and the concentration of thought become difficult and fatiguing. Sleep is unrefreshing and disturbed, and is attended by frequent disorders. The use of the eyes is often accompanied by pain and fatigue, and the sharpness of vision is frequently diminished.

In many cases the patient experiences a disinclination to society; but others are uneasy when left alone. The patient shrinks from walking the streets and facing a crowd; or, on the contrary, he may be overcome by irresistible terror if compelled to cross a wide and lonely space (agoraphobia). Fatigue and excessive perspiration follow slight exertion. Self-confidence disappears, and despondence takes its place.

Spinal neurasthenia is indicated by immoderate fatigue after trifling exertion. The hands tremble, and copious perspiration breaks out after the slightest effort. Various perversions of cutaneous sensation, such as itching, burning, and numbness, are frequently experienced.

Visceral neurasthenia is indicated by depression of the functions of the various organs. After slight exertion the voice is weakened and hoarse, or subjective dyspnœa may be experienced. Not unfrequently there is a sensation of palpitation at the heart, and the functions of digestion are easily disturbed. Sexual power is diminished, and its indulgence is attended with exhaustion.

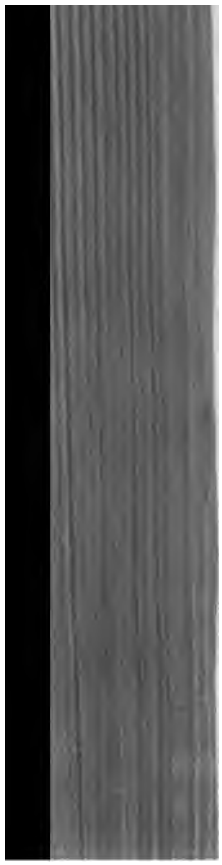
PROGNOSIS. *Neurasthenia*, though not dangerous to life, renders existence almost intolerable. Recovery may be reached through appropriate treatment, but the disease is chronic and liable to relapses.

TREATMENT. The treatment of neurasthenia must be guided by consideration of its special causes. The Weir Mitchell method is often of the greatest service. The patient should be removed from home, if possible, to a place remote from friends and acquaintances, and should be there kept in bed, and abundantly fed with milk and eggs, while massage and electricity are employed every day. This course of treatment should be continued for two or three weeks before the patient is allowed to leave the bed. After that time a gradually increasing amount of locomotion may be allowed. In many cases the treatment must be continued for a number of months. Horseback exercise, massage, and gymnastic training, together with the use of electricity, should form an integral part of the daily life until health is completely restored.

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